APPENDIX TO THE JOURNALS

OF THE

SENATE AND ASSEMBLY

OF THE

THIRTY-FOURTH SESSION

OF THE

LEGISLATURE OF THE STATE OF CALIFORNIA.

VOLUME III.

SACRAMENTO:
A. J. JOHNSTON, : : : : : : : SUPERINTENDENT STATE PRINTING.
1901.

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FOURTH BIENNIAL REPORT

OF THE

BOARD OF TRUSTEES

OF THE

PRESTON SCHOOL OF INDUSTRY

(AT IONE).

JULY 1, 1898, TO JUNE 30, 1900.

SACRAMENTO:
A. J. JOHNSTON, : : : : : SUPERINTENDENT STATE PRINTING.
1900.

REPORT OF TRUSTEES.

Preston School of Industry,
Ione, Cal., August 30, 1900.

To His Excellency Henry T. Gage, *Governor of California:*

Sir: We herewith respectfully submit for your consideration our biennial report for the fiftieth and fifty-first fiscal years.

Since the law went into effect, which imposes on the counties a special tax of $11 per month for the maintenance of the youthful offenders committed by the respective counties to the reformatories, there has been a marked decrease in the number of commitments to these schools and a corresponding increase in the number of boys sentenced to the jails and penitentiaries. Investigation demonstrates that this result is attributable mainly to this special tax, which is obnoxious to the taxpayers. The tax operates as an unjust discrimination against the youthful criminal by imposing a penalty upon the county for committing him to a reformatory, whereas that penalty can be avoided by sending him to prison. Its practical operation is to defeat the very purpose for which a reformatory is maintained, to wit: For the purpose of keeping the youthful offenders away from prison, where they would be compelled to consort with felons and criminals of the most depraved impulses, and placing them in schools where there is at least a chance for their reformation. We therefore request that this law imposing the special tax be repealed.

IMPROVEMENTS OF THE WATER-SUPPLY SYSTEM.

The water system consists of several miles of ditch, a large and expensive storage reservoir, and a pipe-line; the latter consisting of an iron pipe 18 inches in diameter and nearly 6,000 feet in length, which conveys the water under pressure from the ditch to the power-house. The capacity of the storage reservoir is being rapidly diminished by deposits of sand and mud with which the water is charged. We have built settling tanks along the line of the ditch to stop the heavier material from reaching the reservoir, but the limited funds at our disposal are wholly inadequate to preserve the reservoir from ultimate destruction.

The sheet-iron pipe which conveys the water from the ditch to the power-house is old and defective. Breakages along the line are frequent, and expensive repairs are required to keep the line in order. It will soon be too weak to sustain the strain and pressure to which it is subjected. It should be immediately replaced with new pipe, otherwise an accident is liable to occur at any time, which would be attended by serious results. A loss of our water-supply would deprive us of water for extinguishing fires, for power purposes, for electric lighting, and for irrigating the crops.

We urge that an appropriation be recommended for the construction of a settling reservoir on the site now owned by the State, for the construction of additional sand-boxes along the line of the ditch, and for the purchase of new iron pipe to replace the old pipe now in use.

FENCES.

The present fence along the front and sides of the premises consists mainly of old, rusty wire strung upon old, rough posts. These posts are neither useful nor ornamental, as they are too rotten and frail to serve their purpose. The farm fences, too, are old and patched, and wholly inadequate to protect the crops against the incursions of stray stock. As the State has made no appropriation for fencing heretofore, we now ask that money be appropriated for fencing material. The labor of constructing the fences will be done by the inmates of the School.

THE NEW COTTAGES.

The two double cottages are now completed, and the officers of the School will hereafter be enabled to put into operation the more modern and advanced methods of reformatory work. The smaller boys will be separated from the larger ones—the vicious from those who are well disposed. They will be distributed in families of fifty or less each, having separate dormitories, separate school-rooms, and separate playgrounds. Each family will be presided over by a man and wife, who will superintend their domestic and educational training. Under this new arrangement the work of reformation will be more thorough, systematic, and effective than was possible with the congregate system, under which, for lack of adequate accommodations, we have been compelled to operate.

COMMITMENTS.

We respectfully recommend that the law of commitment of boys to the School be so amended as to make all commitments under an indeterminate sentence. Under the indeterminate sentence the term of a boy's detention at the School is made to depend on his own conduct, and the incentive for reformation is correspondingly increased.

APPROPRIATIONS REQUIRED.

We submit the following estimate of appropriations required for the fifty-second and fifty-third fiscal years:

Salaries	$50,000 00
Support	45,000 00
Ice plant	1,500 00
Fencing	1,500 00
Books for library	500 00
Printing press	400 00
Laundry machinery	500 00
Draft horses	500 00
Repairs and improvements, water system	7,000 00
Farming implements	500 00
Band instruments	250 00

Respectfully submitted.

E. M. PRESTON,
C. H. DUNTON,
Board of Trustees.

REPORT OF SUPERINTENDENT.

To the Honorable Board of Trustees of the Preston School of Industry:

Gentlemen: I have the honor to present herewith the Fourth Biennial Report.

Total number of inmates at the commencement of the biennial period was 141. Total number of inmates at the conclusion of said period is 116, which shows a decrease of 25.

I have to attribute this decrease to a continuance of a provision in the law relating to the School, requiring that the county from which a boy is committed shall pay $11 per month, and if the parent or guardian is able to pay, then it is made the duty of the county to collect said $11, and the District Attorney is authorized by law to take the necessary legal steps for the collection of said amount. I can but reiterate what I had to say on this subject in my last report, and to repeat that I cannot see that there is any justice in imposing a charge of $11 for a boy committed to this School, when perhaps a boy of the same age, for a like offense, might be committed to the State Prisons, as some are, where no charge is imposed.

The Institution is reformatory in its character, and if there is any period in the life of a person where in all probability reformation or change can be effected, it is in youth, and before one has entered upon a criminal career. If we succeed in reforming 75 per cent of the boys committed to this School—and these figures are borne out by the experience of this School and institutions throughout the Union—then we are rendering a service to the State by relieving it of the future care and custody of those who otherwise might be committed to penal institutions.

My experience has led me to believe that there is a prejudice in the public mind concerning institutions of this kind, and that the popular fallacy is that to commit a boy to a reform school is to cause him to become more deeply steeped in crime, and to cause his ruin. Some newspapers have even taken this view, and they strengthen an erroneous public sentiment. It requires no argument to demonstrate the fallacy of this and to impress you with the greatness of the work in which we are engaged. Many a boy has become educated in this institution, has learned to become industrious, has acquired a trade, and has gone out into the world able to support himself and to become a respectable

member of society. These boys are the best refutation of these fallacies and prejudices.

All commitments to the School should be for an indeterminate period, or, in other words, all boys should be committed to the School until twenty-one years of age, and their terms shortened or reduced as good conduct in the School justifies. We have frequent instances where boys are committed for a year, and boys committed for like offenses in other counties are sent here for indeterminate periods, which may be all the way from three, five, or nine years, as the case may be. The boy who has been committed for a year or two has been released at the expiration of his term, whether we are justified in the opinion that his reformation has been effected or not, and the boy who is committed for the indeterminate period has to remain, and very properly so, until we are of the opinion that the necessary reformation has been brought about. This inequality in sentences should be done away with, and all boys committed for the indeterminate period, subject to dismissal, as now provided by law, for good conduct.

I cannot too strongly emphasize this thought and impress it upon your Honorable Board, so that the Legislature in turn may be impressed in like manner with a view of having the necessary change brought about.

IMPROVEMENTS.

While some improvement work was done, not as much time could be devoted to it as formerly, in consequence of a large amount of extra work which had to be performed in connection with the new buildings. A large number of trees had to be cut down on sites where buildings were to be erected. Excavations for east and west cottages and for proposed annex to Administration Building. The ground was very hard, and the labor necessary was very considerable. Brickmaking consumed a great deal of time and required the employment of a large number of boys. Handling and hauling brick from brick yard to buildings was a large and tedious job. Handling and hauling brick from depot to grounds required a large detail of boys. Hauling sand to buildings, which under the terms of contract the School was required to do, also took boys and time. In fact, the extra work growing out of the improvements rendered it practically impossible to prosecute any considerable amount of improvement work; still a great deal, considering circumstances, was accomplished.

A three-inch pipe 600 feet in length was run to new west cottage. Several hundred feet of new roadway was built, which necessitated blasting, picking, shoveling, and hauling of immense quantities of dirt and rock, and about three fourths of the proposed work finished. The roadway or approach to the Administration Building is greatly improved,

and eventually we will have built a fine driveway 65 feet wide and a decided improvement to the grounds.

A culvert was placed on Sutter Creek road, to convey irrigating water from the hotbeds across said road.

Assistance was rendered contractor for new furnace in putting in that very much needed improvement. A number of brick manholes to sewer system were built.

A great deal of work was done on ditch and pipe-line and rebuilding and strengthening flumes, all part of the water system of the School.

The levee at Mule Creek was enlarged and improved, and the creek-bed cleaned and the waterway widened. A large culvert was placed on Sacramento road at Slaughter House Gulch, a very much needed and a decided improvement. A large canal was dug on land on west side of road near Mule Creek, many ditches dug, piping laid, and bridges built, all a part of and improvements of the system of irrigation.

A large number of trees were cut on the grounds, which furnished quite a quantity of wood.

The water plant for domestic purposes was greatly improved by the erection of a 2,000-gallon tank in the rear of the building and in a shaded spot. Pipe had to be laid on the outside and inside of building, so that water is now supplied to kitchens, dining-rooms, etc. Formerly the water had to be carried from a wooden tank located on the outside of the building, by hand.

Many other improvements and betterments were made, too numerous to mention in detail.

REPORTS.

The system of monthly reports referred to in the Third Biennial Report has been in operation during the period just closed, and these reports have been presented for your inspection each month. It can be seen at a glance what was accomplished in the various departments for each day as well as for the month, showing the labor performed, supplies used, and articles produced. These reports are bound, and furnish a very interesting history of the institution by its various departments. As improvements in this line suggest themselves they will be included, so that the system of reports now in vogue may be made as near perfect as possible.

FARM.

We have 19 horses in use on the farm, 4 truck wagons, 3 farm wagons, 2 top buggies, 1 two-seated spring wagon, 2 dump carts, 3 driving carts, 1 single road wagon, and all the necessary plows, harrows, mowers, rakes, etc., for farm work.

I am pleased to be able to report a very satisfactory improvement in the work of the farm, as must be patent to the most casual observer.

About 250 acres are farmed for hay and grain, about 30 acres for alfalfa, 50 acres for vegetables, 20 acres for orchard, leaving about 250 acres for grazing purposes. We have raised all the necessary hay for our horses and cows during the past two years, and the outlook for this year is much more encouraging. We will have for this year a largely increased quantity of hay over previous years, probably 250 tons, and something over 500 sacks of oats.

At the suggestion of the Governor, we put in about 4 acres in Italian rye grass, and I have to report that it is doing very well and affords excellent pasturage for cows. We have several green patches of alfalfa and grass throughout the year by reason of our irrigating plant, and hence have an abundance of pasturage for our herd.

The farm earned a credit for the biennial period for products of hay, milk, butter, vegetables, etc., of $13,783.31—a considerable increase.

We raised 300 tons of hay, and produced 473,998 pounds of milk, 2,819 dozen eggs, 5,612 pounds of butter, 2,563 pounds of veal, 6,130 pounds of pork, 3,634 pounds of lard, 240 pounds of bacon, 85 pounds of ham, and 711 quarts of cream.

We have 38 cows, principally of the Holstein-Friesian breed, 1 Holstein bull, 1 Jersey bull, 4 heifers, 7 male calves, 11 female calves, making a total herd of 62. We have in the piggery 100 hogs and pigs of the Poland-China variety, and we also have 300 chickens.

This department of the farm, known as the stock and poultry department, has proved very profitable.

On May 11, 1898, we set in position the separator and established a creamery, since which date we have been prodoucing all of the butter necessary for the institution, and we have been able to make some sales.

During the coming year we hope to increase the acreage of the farm, and make even a more favorable showing than heretofore.

I think I am justified in concluding that the farm is under intelligent management and is producing as favorable results, all things considered, as is possible under the circumstances.

I have given this department a great deal of care and attention during the two years last past, and have rendered it all the assistance and encouragement possible.

Products	$13,783 31
Debits	11,182 67
Profit	$2,600 64

CARPENTRY.

It will be impossible to give in detail all the work performed in this department. While some new work was done, the bulk of the work consisted of repairs and alterations.

Mr. Lamb, the gentleman in charge of this department, was appointed

superintendent of construction, and spent a great deal of his valuable time superintending the construction of the new buildings, though the interest of his department and the instruction of the boys under his care were not neglected. I have to commend the department for good work performed and intelligent and elevating instruction.

The carpenter shop is provided with a band saw, a Sebastian 12-inch lathe with necessary lathe tools, 1 Victor scroll saw, 1 Beech & Brown circular saw, 1 Barnes foot-power former, 1 Barnes working machine, emery wheel, and all the necessary tools for the work in that department.

All the necessary painting and glazing are done in this shop, and it is altogether one of the busiest departments of the School. The machinery contained in the carpenter shop is run by water-power.

TAILORING.

The favorable comment passed in the previous report on this important industry of the School, can but be repeated here.

Mr. Winterberg has rendered the Institution and State good service, and has fitted a number of boys with this useful trade, who are now supporting themselves with this kind of work. His management of the tailor shop has been economical, and the waste has been reduced to the lowest possible minimum. I cannot too strongly favorably commend him.

The shop has five sewing-machines in good order, besides all other necessary tools.

The work and products of the shop were as follows: Boys' coats made, 389; boys' pants made, 533; overalls made, 720; white coats, 53; white pants, 62; shirts, 856; undershirts, 255; drawers, 211; coats repaired, 423; pants repaired, 629; citizens' suits, 63; baseball suits, 8; drawers repaired 282; undershirts repaired, 117; shirts repaired, 1,103.

Products	$4,931 54
Debits	2,586 59
Profit	$2,344 95

SHOEMAKING.

All the shoes (both for cadets and discharged boys), slippers, and suspenders needed in the School are made by the boys working in this department. They have made very satisfactory progress under the instruction of the gentleman in charge of that department, and I know of a number of discharged boys who are engaged at this trade supporting themselves by this means.

Products of the department: 839 pairs of shoes made, 2,010 pairs of shoes repaired, 100 pairs of slippers made, and 525 pairs of suspenders made.

Products	$2,606 70
Debits	1,325 68
Profit	$1,281 02

BLACKSMITH SHOP.

One of the most useful industries of the School is the blacksmith shop, which has been during the past two years in charge of a competent mechanic as well as an efficient official of the School. Quite a number of boys have made satisfactory progress in this useful trade, and have been and are rapidly being fitted to support themselves and to make intelligent mechanics.

The shop is well equipped with 3 anvils, 3 forges, tire bender, tire upsetter, swedge block, combined punch and shears, and a full set of blacksmith and wood-working tools.

Not alone is blacksmithing in all its branches taught in this department, but wood work and wagon-making as well, and a number of very creditable wagons, carts, and buggies have been produced from this shop, together with all kinds of repairs, horseshoeing, and all the necessary blacksmithing work which would be necessary in an institution of this kind.

The total value of work done and articles produced in this department was $3,092.86, and the debit charge against the shop for steel, iron, wood, coal, tools, etc., was $1,514.67, leaving a net credit to the blacksmith shop of $1,578.19, with a very considerable stock on hand.

ELECTRICAL AND ENGINEERING.

The electrical department is equipped with two Westinghouse dynamos, 110 volts, by direct or straight current, and the building lighted with electricity from the same. Capacity of the dynamos is 1,200 16-candle-power incandescent lamps. There are 5 arc lamps on the outside of the building. The dynamos and electrical works are situated in the power-house, and are run by 2 water wheels (48 inches and 36 inches) and 2 water motors (18 inches and 8 inches).

All of the necessary plumbing repairs about the building, of which there has been considerable in the past two years, in consequence of the use by us of muddy water supplied from the power and irrigating plant, and the fact that the plumbing has been in use a long time and is now very much worn, has been done by this department.

The wiring and placing of electrical fixtures in the two new double cottages recently completed were superintended by the head of this department, as was also the superintending of the plumbing, heating, and ventilating work, and the work performed in a satisfactory manner.

The care of the local telephone system is intrusted to this department, as well as all necessary repairs, tinning, and tinkering throughout the establishment.

This is one of the most popular departments in this School, and employment therein is eagerly sought after by boys, and I am happy to

state that a number of boys who graduated from this department have secured profitable positions and are doing well.

It would be impossible to give in detail all the work performed here, and it is sufficient to say that the gentleman in charge, as well as his detail of boys, is always busy.

The care of the ditch, pipe-line, and flume with which water for power and irrigating purposes is conveyed to the School, covering a distance of about 10 miles, is in charge of this department. Several boys at various times have had charge of this system and have rendered good services, and have not, so far as I have been informed, abused the trust in consequence of the necessary liberty given them in this respect.

This department is about to lay a pipe-line from the horse barn to the Randall barn, where cows will be hereafter kept, on the west side of the Sacramento road, a distance of about 1,800 feet, and has already commenced the erection of poles and wiring of same so that the barn located on said place my be connected by telephone and supplied with electric light.

EDUCATIONAL.

The entrants of the school are, as a rule, very deficient. They come with an indifference to educational work, with a lack of previous mental training, and with no development of the study habit. The first endeavor of the educational department is then to overcome these difficulties. It tries to create an interest in the work for the work's sake, to discipline and train the mind, and to develop the power of concentration of thought. Its aim is to overcome prejudices and bitternesses, to widen and broaden the mind and point of view, to teach the application of school work to practical life, to emphasize the importance of common sense and reason, and to make more real the responsibilities and powers of the members of society and the necessity of the rule of law. It wants to develop a normal, healthy mind as the true basis for good reform work.

The great difference in mental capacity, in needs and deficiencies, necessitates, more than elsewhere, a closer adherence to the individual system. Under such conditions as exist here more satisfactory results are gained than by holding too rigidly to the graded system. But this method calls for more of the teacher's time and effort, and since the reduction in the appropriation for the school caused the diminishing of the teaching force from three to two teachers, they are much handicapped in their work. The graded system is an economizer of the teacher's time and effort, for by it more are reached. This advantage is fully appreciated, and consequently it is followed as closely as possible. But with only two school-rooms the desired classification for effective work cannot be fully realized. However, the course of study has been arranged to harmonize as nearly as possible with the best public schools of the State.

PRINTING.

A larger press is needed for the printing department. The press we have now does not permit us to print anything more than the smaller forms and reports, requisitions, and some printing for the school; everything larger than 7 x 9 has to be sent to the State Printing Office, at Sacramento. If we had a larger press, we would make very infrequent demands upon the State Printing Office. The amount paid by us for printing the schedules on which bidders submitted their proposals at the last letting of contracts, namely, $280, would very nearly enable us to purchase the necessary press, so that we could do this work ourselves at a very much reduced cost, and I have respectfully to recommend that an appropriation of $400 be asked for for the purchase of a printing press.

The work in this department has been performed entirely by cadets, and while by no means perfect, has been quite satisfactory and up to our wants.

There have been printed daily reports, requisitions, military reports, laundry lists, receipts for cadets' cash, orders, commissary orders, foreign requisitions, letterheads, billheads, etc.; magazines bound, wornout books rebound, and altogether, at a comparatively slight cost, an efficient department has been maintained.

One of the boys, who was recently discharged, went to a San Francisco printing office and obtained a position as assistant foreman, and what he knew about printing he learned in our printing office. The boy now in charge of the office is doing satisfactory work, and all that he knows about printing he learned here. He in turn is instructing another boy.

All that is asked for is a small appropriation, and it is confidently expected that your Honorable Board will make the necessary request of the Legislature.

Value of work	$740 00
Debits	215 89
Profit	$524 11

LAUNDRY.

The laundry is equipped with a rotary washer, 1 mangle, 1 centrifugal wringer, steam drier, belting and steam connections, soap boiler, wash tubs, etc. The present condition of the machinery is fair, though it will soon be necessary to purchase a new wringer and a new or additional washer, which probably will involve an expenditnre of about $500.

Under the system of reports put into operation since July, 1898, an itemized report of all pieces handled in the laundry is set forth in detail.

The total number of pieces handled in the laundry was 176,787.

Value of work	$5,215 90
Debits	1,347 48
Profit	$3,868 42

PROFITS OF PRODUCING DEPARTMENTS.

Departments.	Products.	Debits.	Profits.
Farm	$13,783 31	$11,182 67	$2,600 64
Shoemaking	2,606 70	1,325 68	1,281 02
Tailoring	4,931 54	2,586 59	2,344 95
Laundry	5,215 90	1,347 48	3,868 42
Blacksmithing	3,092 86	1,514 67	1,578 19
Printing	740 00	215 89	524 11

BAND AND MUSIC.

The band instruments in use have been repaired and renovated from time to time and are in better condition than at the last report. Taking into consideration the fact that the membership of the band is continually changing, I think we have reason to say that its progress has been very satisfactory.

We have had frequent calls for the band from neighboring towns, which invitations have been generally accepted, provided we did not enter into competition with local bands. During the recent Street Carnival at Stockton the band took part by invitation, presented a splendid appearance, and acquitted itself creditably. The band visited Sutter Creek by invitation on the 4th of July, and called forth favorable comment for the music furnished and gentlemanly appearance of the cadets.

Musical instruction to beginners is given in the morning from 10:30 to 11:30, for more advanced pupils from 4:30 to 5:30 in the afternoon, and regular band practice at 6:30 each evening. Concerts are given on Saturday evening at the School, and on Thursday evenings at Ione, and the band assists at drills and parades.

Instruction in vocal music has been given by the Chief Matron, and quite a number of boys have shown a marked degree of proficiency. Chapel exercises on Sunday are made very much more attractive in consequence of good singing by the boys. It is confidently expected to soon establish an orchestra of string and reed instruments.

LIBRARY.

The library has been very much improved by the addition of about 300 volumes during the past two years, making now a total of about 1,000 volumes. The circulation of the library for the past year was 1,742. Boys are encouraged to read good books, and I am pleased to be able to state that a great amount of reading is done by the boys. They are furnished with magazines and daily papers, and given every oppor-

tunity to improve themselves by an acquaintance with good literature. An appropriation of $500 at least should be made for the purchase of books.

MILITARY INSTRUCTION.

Military instruction, which is one of the chief features of the School, is continued by exercises in the morning at 6 o'clock lasting for twenty minutes, consisting of the usual setting-up exercises in use in the United States Army. Company and battalion drills take place about forty-five minutes three times a week, and dress parade on Sundays.

The hope expressed last year to be able to procure arms has been realized by having wooden guns in imitation of the regulation army rifle, made in the carpenter shop of this School. This has contributed greatly to the interest and efficiency of the drill, as can be readily understood. Marching and drilling without arms under the most favorable circumstances are tiresome, and this difficulty has been overcome in the equipping of the battalion with the wooden muskets, which, as before stated, makes the drill very much more interesting and adds considerably to the appearance of the battalion when on parade or drill.

NEEDS OF THE INSTITUTION.

We need an ice-making plant, for which $1,500 should be appropriated.

We need an appropriation of $1,500 for fences.

We need $500 for purchase of books for the library.

We need an appropriation of $400 for a printing press.

We need an appropriation of $500 for the laundry.

We must make a further and stronger effort to secure an appropriation of not less than $7,000, and possibly more, for improvement of our water system. The main pipe-line, nearly a mile long, will soon have to be replaced with a new pipe; the large reservoir will have to be cleaned of sand which has settled in immense quantities, or the purchase of a new site made. Both improvements would be desirable.

We should have an appropriation of $250 for the purchase of new band instruments. Those at present in use cost more to repair them than they are worth.

CONCLUSION.

I cannot close this report, which has been made as brief as possible, without testifying my sincere appreciation of consideration and kindness shown me by the Honorable Board of Trustees, whose advice, counsel, and direction have indeed been invaluable. My associates in the work have been willing, prompt, and cheerful in the performance of duty, and to them much credit is due.

Very respectfully,

D. S. HIRSHBERG,
Superintendent.

TABLE I.

Showing Number Admitted and Released.

Nativity.	Number Com'it'ed Since Opening.	Number in School June 30, 1898.	1898-1899.		1899-1900.		Number in School, June 30, 1900.
			Admitted.	Released.	Admitted.	Released.	
White boys	405	128	48	55	28	48	100
Colored boys	19	11	3	2	2	1	14
Indians	4	2	0	1	1	0	2
Totals	428	141	51	58	31	49	116

Whole number admitted	428
Whole number released	312
Whole number in institution	116

TABLE II.

Number Received by Months and Years.

Years.	July	August	September	October	November	December	January	February	March	April	May	June	Total for Years
1898-1899	2	6	3	6	3	1	7	2	3	9	7	2	51
1899-1900	3	2	2	3	3	4	4	4	4	0	1	1	31
Previous													346
Total													428

TABLE III.

Counties from which Boys Have Been Received.

Counties.	Previous.	1898-1899.	1899-1900.	Total.	Per Cent.
Alameda	53	9	7	69	16.076
Amador	5	1	0	6	1.398
Butte	6	0	0	6	1.398
Colusa	6	0	0	6	1.398
El Dorado	0	1	0	1	.233
Fresno	2	0	0	2	.466
Glenn	1	0	0	1	.233
Humboldt	2	4	1	7	1.631
Kern	10	0	0	10	2.330
Lake	1	0	0	1	.233
Los Angeles	39	13	6	58	13.513
Madera	0	0	1	1	.233
Mendocino	1	2	0	3	.698
Merced	6	1	0	7	1.631
Modesto	0	0	1	1	.233
Monterey	6	0	0	6	1.398
Nevada	2	0	0	2	.466
Orange	4	0	0	4	.932
Placer	1	1	0	2	.466

TABLE III—Continued.

Counties.	Previous.	1897–1899.	1899–1900.	Total.	Per Cent.
Santa Clara	4	1	2	7	1.631
Sacramento	6	3	3	12	2.796
San Diego	5	2	1	8	1.864
San Francisco	126	2	4	132	30.705
San Joaquin	4	5	0	9	2.097
San Luis Obispo	3	0	0	3	.698
Santa Cruz	7	1	2	10	2.330
Siskiyou	5	0	0	5	1.165
Solano	7	2	1	10	2.330
Sonoma	13	1	2	16	3.727
Stanislaus	2	1	0	3	.698
Tulare	17	1	0	18	4.194
Tuolumne	2	0	0	2	.466
Ventura	1	0	0	1	.233
Totals	346	51	31	428	100.000

TABLE IV.

Causes of Commitment.

Offense.	1898–1899.	1899–1900.	Previous.	Total.	Per Cent.
Burglary	26	7	98	131	30.607
Grand larceny	8	6	32	46	10.747
Larceny	14	8	87	109	25.467
Vagrancy	1	2	81	84	19.666
Forgery	0	0	5	5	1.165
Misdemeanor	0	0	4	4	.932
Attempt to rape	0	0	4	4	.932
Indecent exposure	0	0	1	1	.233
Disturbing peace	0	0	2	2	.466
Felony	0	0	2	2	.466
Malicious mischief	0	1	6	7	1.631
Assault	0	1	4	5	1.165
Battery	0	0	3	3	.698
Indecent assault	0	0	2	2	.466
Vulgar language	0	0	1	1	.233
Obtaining money under false pretenses	0	0	1	1	.233
Incorrigibility	1	2	2	5	1.165
Infamous crime	0	0	2	2	.466
Embezzlement	0	2	5	7	1.631
Robbery	1	0	1	2	.466
Arson	0	0	1	1	.233
Assault with deadly weapon	0	0	2	2	.466
Assault with intent to commit murder	0	1	0	1	.233
Rape	0	1	0	1	.233
Totals	51	31	346	428	100.000

TABLE V.

Court by which Commitments Were Made.

Court.	1898–1899.	1899–1900.	Previous Years.	Total.	Per Cent.
Superior Court	51	31	217	299	69.862
Police Court	0	0	98	98	22.898
Justice's Court	0	0	27	27	6.309
Recorder's Court	0	0	1	1	.233
Returned from parole	0	0	3	3	.698
Totals	51	31	346	428	100.000

TABLE VI.

Age of Boys when Committed.

Age.	1898-1899.	1899-1900.	Previous Years.	Total.	Per Cent.
Eight years	0	0	1	1	.233
Nine years	1	0	0	1	.233
Ten years	0	0	2	2	.466
Eleven years	0	2	15	17	3.970
Twelve years	4	1	12	17	3.970
Thirteen years	2	4	29	35	8.269
Fourteen years	5	3	47	55	12.829
Fifteen years	5	3	57	65	15.249
Sixteen years	18	12	67	97	22.607
Seventeen years	14	4	106	124	28.892
Eighteen years	2	2	9	13	3.049
Nineteen years	0	0	0	0	.000
Twenty years	0	0	1	1	.233
Totals	51	31	346	428	100.000

TABLE VII.

Nativity of Boys.

	1898-1899.	1899-1900.	Previous Years.	Total.	Per Cent.
United States.					
Alabama	0	0	1	1	.233
Arizona	1	0	3	4	.932
Arkansas	1	0	2	3	.698
California	29	18	216	263	61.485
Colorado	1	0	1	2	.466
North Dakota	0	0	4	4	.932
Florida	0	0	1	1	.233
Georgia	1	0	2	3	.698
Illinois	0	0	7	7	1.631
Indian Territory	0	0	1	1	.233
Indiana	0	0	3	3	.698
Iowa	2	1	5	8	1.864
Kansas	0	1	4	5	1.165
Louisiana	0	0	2	2	.466
Maryland	0	0	2	2	.466
Massachusetts	0	1	3	4	.932
Minnesota	2	0	1	3	.698
Michigan	0	0	2	2	.466
Missouri	2	1	9	12	2.816
Nebraska	1	0	2	3	.698
New Jersey	0	0	2	2	.466
New York	2	4	10	16	3.768
Nevada	0	0	11	11	2 579
North Carolina	0	1	1	2	.466
Ohio	0	1	4	5	1.165
Oregon	1	0	5	6	1.398
Pennsylvania	0	1	2	3	.698
Texas	2	0	3	5	1.165
Tennessee	0	1	1	2	.466
Utah	0	0	1	1	.233
Washington	0	0	1	1	.233
Totals	45	30	312	387	90.447

TABLE VII—Continued.

	1898-1899.	1899-1900.	Previous Years.	Total.	Per Cent.
Foreign Countries.					
Australia	0	0	1	1	.233
Austria	0	0	1	1	.233
Canada	0	0	4	4	.932
England	0	0	6	6	1.399
France	0	1	2	3	.698
Germany	2	0	1	3	.698
Ireland	0	0	2	2	.466
Italy	0	0	3	3	.698
Mexico	1	0	3	4	.932
Newfoundland	0	0	1	1	.233
Scotland	1	0	2	3	.698
Switzerland	0	0	1	1	.233
Unknown	1	0	7	8	1.867
Portugal	1	0	0	1	.233
Totals	6	1	34	41	9.553

Recapitulation.

	Number.	Per Cent.
United States	387	90.447
Foreign Countries	25	5.825
Unknown	16	3.728
Totals	428	100.000

TABLE VIII.

Nativity of Boys' Fathers.

Country.	1898-1899.	1899-1900.	Previous Years.	Total.	Per Cent.
America	20	11	136	167	39.115
Austria	0	0	1	1	.233
Belgium	0	1	1	2	.466
Denmark	0	0	1	1	.233
England	4	4	18	26	6.068
France	0	2	7	9	2.097
Germany	4	2	36	42	9.799
Ireland	1	3	42	46	10.738
Italy	0	0	12	12	2.796
Mexico	1	1	10	12	2.796
Nova Scotia	0	0	3	3	.698
Portugal	2	0	3	5	1.165
Scotland	2	1	3	6	1.398
Spain	1	0	1	2	.466
Sweden	0	0	2	2	.466
Switzerland	0	0	2	2	.466
Wales	0	0	2	2	.466
Colored	3	2	13	18	4.199
Unknown	11	3	50	64	14 937
Jerusalem	0	0	1	1	.233
Chili	1	0	1	2	.466
Norway	0	0	1	1	.233
Russia	1	0	0	1	.233
Canada	0	1	0	1	.233
Totals	51	31	346	428	100.000

TABLE IX.

Nativity of Boys' Mothers.

Country.	1898-1899.	1899-1900.	Previous Years.	Total.	Per Cent.
America	16	18	146	180	41.998
Australia	0	0	1	1	.233
Austria	0	0	1	1	.233
Belgium	0	0	0	0	.000
Canada	1	1	6	8	1.874
England	2	2	15	19	4.467
France	0	1	6	7	1.641
Germany	4	1	17	22	5.166
Ireland	1	1	48	50	11.685
Italy	0	0	11	11	2.573
Mexico	1	1	10	12	2.799
Colored	3	2	11	16	3.743
Portugal	2	0	2	4	.932
Scotland	0	1	4	5	1.170
Spain	0	0	2	2	.466
Switzerland	0	0	2	2	.466
Unknown	18	3	59	80	18.673
New Zealand	0	0	1	1	.233
Sandwich Islands	0	0	1	1	.233
Wales	0	0	1	1	.233
Norway	1	0	1	2	.466
Sweden	0	0	1	1	.233
Bohemia	1	0	0	1	.233
Russia	1	0	0	1	.233
Totals	51	31	346	428	100.000

TABLE X.

Religious Beliefs.

Religion.	Boys.	Per Cent.	Religion.	Boys.	Per Cent.
Adventist	3	.698	Methodist	54	12.596
Baptist	25	5.835	Presbyterian	39	9.097
Catholic	182	42.594	United Brethren	3	.698
Christian	24	5.597	Unitarian	1	.233
Congregational	9	2.097	No religion	56	13.084
Episcopal	14	3.277	Mormon	1	.233
German Lutheran	5	1.165			
Jewish	12	2.796	Totals	428	100.000

TABLE XI.

Habits of Parents.

Fathers temperate	311	Mothers temperate	398
Fathers intemperate	117	Mothers intemperate	30
Total	428	Total	428

TABLE XII.

Home Relations.

Lost father only	102
Lost mother only	64
Lost both	44
Both living	216
Unknown	2
Total	428

TABLE XIII.

Disposition of Boys Released.

	1898–1899.	1899–1900.	Totals.
Number discharged	50	22	72
Number granted parole	4	16	20
Number escaped	1	6	7
Number returned to State Prison	0	1	1
Number returned to Court (improper subjects)	1	2	3
Number granted new trial	0	0	0
Number returned to Court (imperfect commitment)	0	0	0
Number released on new warrant	0	0	0
Number died	2	2	4
Totals	58	49	107

TABLE XIV.

Number of Boys Released, by Months and Years.

Years.	July	August	September	October	November	December	January	February	March	April	May	June	Totals
1898–99	1	1	3	9	7	8	5	1	6	3	5	7	56
1899–00	6	2	6	9	3	4	3	0	2	5	7	0	47
Died	2	0	0	1	0	0	0	1	0	0	0	0	4
Totals	9	3	9	19	10	12	8	2	8	8	12	7	107

TABLE XV.

Average Number Months Boys Remained in Institution.

Fiscal Year 1898–1899.	Average Number Months.	Fiscal Year 1899–1900.	Average Number Months.
Boys released on parole	44.5	Boys released on parole	41.7
Boys discharged	39.0	Boys discharged	38.4
Boys escaped	14.5	Boys escaped	22.5
Boys returned (imp. subjects)	15.0	Boys returned (imp. subjects)	19.0

TABLE XVI.

Number of Boys Employed in Different Departments at Close of Fiscal Year.

Departments.	1898-1899.	1899-1900.	Departments.	1898-1899.	1899-1900.
Tailoring	10	4	Hospital	4	10
Shoemaking	9	2	Office	2	2
Carpentering	6	4	Housework	17	16
Printing	1	1	Miscellaneous	4	6
Engineer	6	9	Commissary	3	1
Laundry	8	5	Horticultural	8	8
Bakery	4	5	Blacksmithing	5	5
Cookery	11	7	Brickyard	9	0
Agricultural	19	17			
Dining rooms	14	14	Totals	141	116

SECRETARY'S REPORT.

WATERMAN, AMADOR COUNTY, CAL., August 1, 1900.

To the Honorable Board of Trustees of the Preston School of Industry:

GENTLEMEN: I herewith submit for your consideration a full statement of the financial transactions of the Preston School of Industry for the fiftieth and fifty-first fiscal years, ended June 30, 1900, in the following numbered tables, to wit:

Table No. 1—Cash receipts.
Table No. 2—Cash disbursements.
Table No. 3—Collections deposited in Contingent Fund.
Table No. 4—Stock issued by the Commissary.
Table No. 5—Department issues by the Commissary.
Table No. 6—Exhibit of financial condition June 30, 1900.

Very respectfully,

B. T. K. PRESTON,
Secretary.

TABLE No. 1.

Cash Receipts during Fiftieth and Fifty-first Fiscal Years.

Months.	Salary Fund.	Support Fund.	Improvement Fund (Act of April 1, 1897.)	Equipment Fund (Act of April 1, 1897.)	Contingent Fund.	Totals.
1898—July	$2,285 34	$3,617 44	$288 50			$6,191 28
Aug.	2,289 83	3,346 61	645 46	$79 33	$24 13	6,385 36
Sept.	2,192 83	2,484 02	1,842 73	225 06		6,744 64
Oct.	2,173 00	3,108 16	404 38	239 63	10 00	5,935 17
Nov.	2,362 66	2,837 61	323 00			5,523 27
Dec.	2,285 38	3,281 53			37 50	5,604 41
1899—Jan.			494 10		42 10	536 20
Feb.	4,421 90	3,429 50	1,171 80	101 20		9,124 40
March	2,146 57	2,451 17	6,442 42	58 92	60 34	11,159 42
April	2,152 91	4,986 08	1,702 57	9 43		8,850 99
May	2,237 33	2,467 17	2,825 95			7,530 45
June	2,248 07		2,599 28	197 46		5,044 81
July	2,232 33		1,024 02			3,256 35
Aug.	1,873 32	6,106 62	282 42			8,262 36
Sept.		1,825 35		337 15	100 00	2,262 50
Oct.	3,746 66	1,670 51	5,295 53			10,712 70
Nov.	1,874 62	1,820 60				3,695 22
Dec.	1,867 99	3,933 64	5,882 95		29 50	11,714 08
1900—Jan.	1,847 14					1,847 14
Feb.	1,833 32	3,669 84	1,935 40			7,438 56
March	1,870 33	1,670 37	2,934 34			6,475 04
April	1,862 99	2,037 27	2,747 16		140 30	6,787 72
May	1,878 33	1,843 76	4,652 01		150 00	8,524 10
June	1,835 34	1,548 77			238 75	3,622 86
Totals	$49,518 19	$58,136 02	$43,494 02	$1,248 18	$832 62	$153,229 03

TABLE No. 2.

Cash Disbursements during the Fiftieth and Fifty-first Fiscal Years.

Months.	New Buildings. (Act of April 1, 1897)	Printing Materials, Horses, Cows, Tools, Etc. (Act of April 1, '97.)	Salary	Support	Medical Service	Advertising	Freight and Expressage	Recovery of Escapes	Postage	Telegraph and Telephone	Traveling Expenses	Trustees' Expenses	Miscellaneous Expenses	Totals
1898—July	$288 50		$2,285 34	$3,419 36			$10 43	$27 60	$12 60	$6 40	$29 85	$82 05	$29 15	$6,191 28
August	645 46	$79 33	2,289 83	3,133 82		$34 50	41 44	55 85	19 45	24 92	34 31	17 60	8 85	6,385 36
September	1,842 73	225 06	2,192 83	2,176 33			20 75	64 60	20 10	15 44	39 10	34 75	112 95	6,744 64
October	404 38	239 63	2,173 00	2,446 80			5 12	214 60	10 00	22 75	65 01	54 35	299 53	5,935 17
November	323 00		2,362 66	2,404 39			11 52	124 05	11 00	24 45	41 72	24 10	196 38	5,523 27
December			2,285 38	2,986 28			11 90	148 70	27 20	26 02	67 52	17 35	34 06	5,604 41
1899—January	494 10							42 10						536 20
February	1,171 80	101 20	4,421 90	3,031 17			19 82	249 65	10 10	29 50	19 90	56 75	12 61	9,124 40
March	6,442 42	58 92	2,146 57	2,048 15	7 00		9 20	266 90	10 85	21 67	27 15	48 40	72 19	11,159 42
April	1,702 57	9 43	2,152 91	4,755 82	13 50		22 66	70 55	20 50	25 20	26 20	38 45	13 20	8,850 99
May	2,825 95		2,237 33	2,042 49	7 00		6 48	178 00	23 00	45 60	30 30	111 00	23 30	7,530 45
June	2,599 28	197 46	2,248 07											5,044 81
July	1,024 02		2,232 33											3,256 35
August	282 42		1,873 32	5,556 64	9 00	30 00	22 08	272 30	25 00	22 42	26 05	66 55	76 58	8,262 36
September		337 15		1,638 93			22 17	36 35	13 00	9 80	14 70	37 25	153 15	2,262 50
October	5,295 53		3,746 66	1,498 43	13 50		14 93	10 00	11 00	11 65	35 65	36 65	38 70	10,712 70
November			1,874 62	1,537 77	2 00		6 78	142 85	26 20	15 15	27 25	45 80	16 80	3,695 22
December	5,882 95		1,867 99	3,475 89	9 00		16 90	82 01	20 00	21 29	84 85	24 70	228 50	11,714 08
1900—January			1,847 14											1,847 14
February	1,935 40		1,833 32	3,417 77	3 00		20 82	121 35	22 00	12 30	27 35	43 40	1 85	7,438 56
March	2,934 34		1,870 33	1,536 14	6 50		5 93	61 35	14 00	9 90	9 15	27 40		6,475 04
April	2,747 16		1,862 99	1,959 84			17 72	132 70	17 00	6 21	14 30	27 30	2 50	6,787 72
May	4,652 01		1,878 33	1,824 70	6 25		13 60	43 86	14 00	13 60	35 95	26 80	15 00	8,524 10
June			1,835 34	1,433 25		34 00	15 92	15 15	10 00	4 25	11 80	18 05	245 10	3,622 86
Totals	$43,494 02	$1,248 18	$49,518 19	$52,323 97	$76 75	$98 50	$316 17	$2,360 52	$337 00	$368 52	$668 11	$838 70	$1,580 40	$153,229 03

TABLE No. 3.

Cash Collections Deposited in the Contingent Fund during Fiftieth and Fifty-first Fiscal Years.

Months.	Drayage on Contract Supplies	Shoemaking Department	Tailoring Department	Agricultural Department	Carpentering Department	Blacksmithing Department	Hospital Department	Brickmaking Department	Sales from Commissary Department	Waterpower Department	Printing Department	Totals.
1898—July	$13 66											$13 66
August		$3 00							$0 54	$1 00		4 54
September	24 35	3 25		$43 38								70 98
October	5 25		$7 85	35					18 85			32 30
November	11 54	1 00	17 10	24 30				$8 00	1 55			63 49
December	13 10	1 75										14 85
1899—January	9 00		8 25						70			17 95
February	18 28	8 50							1 40			28 18
March	10 26	5 75	12 00	27 00	$0 65							55 66
April	17 04	4 00	2 00	5 04		$6 00						34 08
May	8 05	4 75										12 80
June		1 00									$0 10	1 10
July		9 25				11 90	$5 80					26 95
August	20 59	2 00		5 90	2 50							30 99
September	5 25			10 00								15 25
October	10 77	1 25										12 02
November	6 78							5 40				12 18
December	13 63	4 75		13 00			1 25					32 63
1900—January				72 44								72 44
February	28 59											28 59
March	1 35			2 40								3 75
April												
May								4 00				4 00
June		8 25										8 25
Totals	$217 49	$58 50	$47 20	$203 81	$3 15	$17 90	$7 05	$17 40	$23 04	$1 00	$0 10	$596 64

TABLE No. 4.

Exhibit of Supplies Issued by the Commissary during Fiftieth and Fifty-first Fiscal Years.

Months.	Subsistence.	Soap, Starch, Soda, Etc.	Fuel—Wood and Coal.	Clothing, Hats, and Caps.	Brooms and Brushes.	Crockery.	Stationery and Books.	Paints and Oils.
1898—July	$1,500 00	$54 58	$715 45	$33 21	$16 68	$18 73	$122 09	$10 81
August	1,491 55	37 16	542 50	3 20	3 94	13 04	11 78	67 47
September	1,497 01	42 57	422 40	44 51	15 50	13 33	253 38	21 10
October	1,341 62	45 17	32 71	40 28	11 66	20 18	35 78	15 59
November	1,322 12	37 22	858 67	45 27	9 43	15 24	38 23	135 89
December	1,317 48	70 96	251 47	54 92	12 14	41 14	21 39	30 02
1899—January	1,295 08	44 77	23 38	23 17	11 86	22 36	43 70	20 12
February	1,260 30	32 32	212 90	21 76	9 74	22 92	59 03	13 12
March	1,347 23	24 02	226 00	29 34	9 94	8 06	30 19	22 63
April	1,282 89	33 65	163 80	28 98	6 82	18 57	39 53	13 73
May	1,312 06	19 21	161 03	36 48	11 41	18 65	19 27	169 88
June	1,282 46	32 67	15 61	9 14	15 00	35 64	234 59	35 33
July	1,482 84	26 93	201 32	19 32	8 49	15 36	28 30	6 24
August	1,505 03	32 83	202 91	24 40	13 39	15 72	18 38	27 58
September	1,313 06	21 17	350 91	9 92	16 97	8 08	10 70	22 45
October	1,202 48	42 59	336 52	11 59	12 27	8 05	13 20	11 19
November	1,170 19	20 06	245 58	8 21	12 22	14 78	13 93	101 88
December	1,098 13	39 54	331 07	11 73	12 93	10 58	42 08	10 12
1900—January	1,070 92	19 20	205 87	15 86	12 18	13 91	24 46	17 06
February	996 22	31 76	249 59	13 40	12 58	5 53	21 95	94 23
March	1,097 85	21 92	227 00	13 33	13 11	15 57	65 29	43 92
April	1,070 88	37 21	181 15	17 98	18 66	30 14	38 63	30 37
May	1,123 73	28 81	118 06	10 87	22 67	8 77	25 00	27 79
June	1,321 40	42 38	117 11	14 66	7 31	13 66	29 73	13 62
Totals	$30,702 53	$838 70	$6,393 01	$541 53	$296 90	$408 01	$1,240 61	$962 14

TABLE NO. 4—Continued.

Months.	Cloth.	Dry Goods, Clothing.	Hardware.	Drugs and Medicines.	Garden Seeds, Plants, Etc.	Forage.	Leather and Findings.	Photo Materials.
1898—July	$141 36	$134 22	$301 01	$28 42	----	$75 83	$60 60	----
August	68 13	70 03	414 02	33 21	$9 60	187 88	131 71	$4 00
September	----	89 91	434 36	15 28	----	1,465 03	62 31	11 75
October	157 05	337 87	179 83	26 77	88 09	174 28	104 03	3 45
November	----	194 32	201 96	28 46	120 00	157 41	46 89	2 50
December	125 33	195 79	235 64	28 27	105 85	266 40	228 29	1 40
1899—January	135 21	82 88	115 27	28 15	33 63	197 17	123 51	8 00
February	133 06	76 09	151 31	52 79	106 03	181 92	40 40	2 00
March	----	108 29	213 70	43 32	----	289 30	115 28	4 45
April	81 51	58 47	2,745 38	33 83	17 35	166 18	58 16	5 50
May	49 78	141 53	518 53	28 99	6 83	214 52	138 64	2 66
June	38 53	188 27	499 72	36 84	3 57	98 53	325 15	5 35
July	27 62	20 88	37 57	26 89	1 25	1,077 11	23 23	20
August	59 06	30 07	125 20	24 91	2 78	146 83	49 96	9 87
September	76 57	42 06	144 04	56 92	----	84 05	55 53	16 51
October	48 12	109 73	349 64	110 90	----	176 74	70 12	2 75
November	41 70	88 99	98 94	38 61	136 71	119 88	53 36	----
December	85 27	76 23	239 76	17 94	19 60	141 04	91 98	----
1900—January	7 04	74 78	322 41	28 28	55 50	110 71	57 14	5 40
February	78 87	65 78	182 39	29 14	18 19	107 81	75 36	7 80
March	39 23	70 70	280 96	25 38	41 02	94 66	66 31	23 10
April	60 08	116 47	223 34	17 93	6 67	128 00	79 76	4 90
May	69 56	76 24	160 59	42 69	9 50	137 11	75 11	1 00
June	136 64	96 41	53 44	10 62	1 00	1,515 05	76 62	2 95
Totals	$1,659 72	$2,546 01	$8,229 01	$814 54	$783 17	$7,313 44	$2,209 45	$125 54

TABLE No. 4—Continued.

Months.	Lumber.	Miscellaneous.	Lime and Cement.	Uniform Buttons.	Boots and Shoes.	Furniture.	Live Stock.
1898—July	$142 54	$284 34					
August	42 97	74 05					
September	75 40	15 13					
October	320 92	66 99					
November	42 89	21 55					
December	86 02	259 52					
1899—January	61 45	88 29					
February	81 19	68 59					
March	78 78	50 48					
April	147 47	76 55					
May	174 00	210 14					
June		216 36					
July	13 24	77 18					
August		72 56					
September	50 00	18 68					
October		25 43					
November		25 57			$6 00		
December		25 94	$228 60				
1900—January		26 84			5 00		
February		14 62		$23 25	29 25		
March	67 19	69 24	228 60			$120 30	$20 00
April		34 74	7 50			30 30	150 00
May		85 31			3 50		
June	190 66	41 04	14 85				
Totals	$1,574 72	$1,949 14	$479 55	$23 25	$43 75	$150 60	$170 00

TABLE No. 5.

Exhibit of Issues to the Several Departments by the Commissary, during the Fiftieth and Fifty-first Fiscal Years, including Products of Farm, and Garden and Orchard.

Months.	Superintendent's Residence.	Offices.	Boys' Mess.	Officers' Mess.	Academic Department.	Hospital Department.	Commissary Department.	Library.	Photographic Department.
1898—July	$51 35	$16 64	$958 19	$506 49	$4 62	$64 46	$30 53	----------	$10 00
August	52 19	5 12	991 69	472 50	3 30	36 22	1 63	----------	4 00
September	43 62	8 82	1,055 46	503 26	4 77	28 64	2 11	$239 63	11 79
October	75 78	7 17	826 83	498 96	57	26 30	2 47	2 94	3 47
November	47 58	13 23	957 07	471 23	5 80	34 36	14 65	22	2 14
December	62 40	19 40	888 77	552 11	2 79	44 22	2 73	14 46	1 44
1899—January	41 67	18 12	846 72	500 97	17 49	39 93	13 86	46 80	8 00
February	40 72	12 01	847 71	507 17	25 60	73 03	2 15	----------	2 05
March	49 36	5 51	896 74	474 91	6 44	51 98	3 10	9 37	4 55
April	33 85	9 40	886 14	448 22	7 88	46 29	1 30	2 97	5 84
May	27 65	3 78	913 21	463 63	5 95	41 82	90	08	4 46
June	116 15	15 28	766 74	437 87	9 31	67 69	4 14	179 43	5 35
July	108 06	16 94	830 90	607 69	2 65	39 95	5 59	1 62	20
August	42 41	11 53	949 03	595 52	1 43	41 08	39	8 62	9 87
September	65 49	3 17	836 46	466 92	5 85	85 60	10	----------	16 51
October	66 45	9 38	681 36	482 02	51	172 86	2 10	24	2 75
November	47 69	5 84	698 59	500 63	4 20	93 21	2 05	51	1 00
December	17 97	4 16	707 98	437 07	15 02	50 50	1 97	26 45	----------
1900—January	35 21	3 42	635 26	450 02	14 67	68 58	3 45	4 21	5 40
February	36 30	3 95	653 08	429 05	9 20	51 88	----------	2 55	8 13
March	54 69	7 69	660 31	464 84	31 56	44 65	6 73	3 55	23 40
April	64 17	2 05	631 37	470 80	6 31	22 68	1 59	13 00	5 60
May	48 58	3 46	669 37	463 28	1 21	47 19	----------	64	1 25
June	82 56	4 07	719 71	595 89	1 71	33 62	5 01	2 19	2 95
Totals	$1,311 90	$210 14	$19,508 69	$11,801 05	$188 84	$1,306 74	$108 55	$559 48	$140 15

TABLE No. 5—Continued.

Months.	Agricultural Department.	Horticultural Department.	Laundry.	Bakery.	Blacksmith's Department.	Carpenter's Department.	Tailor's Department.	Shoemaker's Department.	Printer's Department.
1898—July	$125 35	$46 35	$75 69	$16 98	$215 80	$3 69	$28 51	$34 84	----
August	267 33	26 57	17 10	43 99	153 55	56 64	15 66	94	----
September	1,524 48	1 89	25 01	23 16	110 05	2 10	12 50	31 81	$0 22
October	214 96	90 49	28 39	25 62	45 61	36 10	228 54	117 86	8 37
November	397 26	22 49	97 27	24 23	42 25	19 93	12 72	48 55	27 44
December	673 66	26 47	134 94	24 22	35 72	3 18	18 43	141 42	10 39
1899—January	242 38	17 90	14 21	19 03	38 97	68 14	52 12	124 10	1 83
February	245 21	69 99	18 28	38 74	129 87	73	14 76	80	17 27
March	355 01	6 04	99 75	1 15	96 77	39 82	33 86	6 00	20 86
April	555 72	31 48	44 53	34 96	90 33	----	16 00	5 29	26 63
May	535 96	100 10	16 53	25 29	299 85	189 54	1 25	7 88	1 54
June	551 16	98 55	29 88	17 93	105 43	54 16	1 81	50 30	31 48
July	1,107 15	4 29	61 37	19 28	50	18 11	13 76	24 08	3 42
August	176 62	35 39	65 05	23 45	2 88	7 51	19 36	49 84	2 06
September	95 53	----	58 05	25 62	93	7 12	2 41	57 28	74
October	291 43	----	88 59	4 22	26 03	70	4 64	62 97	2 03
November	302 89	2 69	47 39	37 20	1 00	38 88	2 76	54 81	9 50
December	206 20	27	81 46	38 87	23 81	9 98	3 41	74 74	17 27
1900—January	213 75	----	73 44	26 21	----	56 34	4 47	59 09	4 66
February	175 90	18 16	47 17	50 16	2 65	85 17	9 99	66 24	4 96
March	177 27	11 60	35 36	89 35	35 07	109 94	16 82	68 43	13 75
April	346 29	----	89 78	27 71	31 12	33 56	11 23	92 19	9 78
May	250 57	----	41 08	17 71	26 48	5 75	1 35	75 95	31
June	1,538 87	1 00	57 16	30 49	----	89 16	7 74	70 27	1 38
Totals	$10,570 95	$611 72	$1,347 48	$685 57	$1,514 67	$936 25	$534 10	$1,325 68	$215 89

TABLE NO. 5—Continued.

Months.	Housekeeper's Department.	Engineer's Department.	Boys' Supply.	Officers' Supply.	Improvements.	Officers' Rooms.	Barber's Departm't.	Repairs.	Products of Farm, Orchard and Garden Included. Farm.	Products of Farm, Orchard and Garden Included. Orchard and Garden.
1898—July	$8 44	$523 05	$358 25	$13 95	$131 32				$297 05	$90 85
August	15 81	27 05	319 16	10	167 36				372 60	125 10
September	38 12	351 95	432 70	04	341 07				374 85	176 48
October	165 00	82	294 42	05	374 31				255 71	80 15
November	28 65	98 73	251 43	29	387 43				286 12	69 60
December	10 27	137 67	419 56		71 36				284 71	122 85
1899—January	34 11	8 73	219 04		54 87				380 45	15 95
February	16 35	80 55	290 88		101 76				413 13	22 70
March	10 59	161 02	204 87		74 22				480 96	22 90
April	9 28	43 29	270 84		2,380 74				485 77	26 75
May	15 98	158 31	349 31		190 41				489 41	20 75
June	67 45	168 71	307 01		357 35				414 13	28 63
July	61 04	103 87	59 35			$0 95	$3 20		1,436 56	135 30
August	40 62	113 77	139 49		74 06				475 35	276 55
September	24 61	261 65	138 05	38	157 15				376 85	159 40
October	9 25	303 12	167 10		172 92	65		$12 00	458 33	96 56
November	13 55	131 63	104 57		40 57			56 45	441 37	12 60
December	25 70	257 36	166 37			75			378 09	10 99
1900—January	16 85	168 44	75 62	11	156 86				392 90	12 50
February	30 73	168 40	168 05						418 24	13 25
March	165 43	219 35	153 99		57 25			5 40	407 21	35 85
April	40 34	123 69	180 69					31 30	351 85	44 35
May	58 53	156 54	150 10	1 71				5 25	359 05	57 75
June	43 31	44 86	251 85		11 16				1,737 27	153 73
Totals	$950 01	$3,812 56	$5,472 70	$16 63	$5,302 17	$2 35	$3 20	$110 40	$11,767 96	$1,811 54

TABLE No. 6.

Exhibit of Financial Situation June 30, 1900.

SALARY FUND.			
Appropriation (Act of April 1, 1897)		$55,000 00	
Disbursements		53,397 18	
Balance unavailable			$1,602 82
Appropriation		$45,000 00	
Disbursements to date	$20,490 04		
June salaries (unpaid)	1,862 33		
		22,352 37	
Balance available			$22,647 63
SUPPORT FUND.			
Appropriation (Act of April 1, 1897)		$70,000 00	
Disbursements		67,485 47	
Balance unavailable			$2,514 53
Appropriation		$45,000 00	
Disbursements to date	$19,931 79		
June claims (unpaid)	2,371 80		
		22,303 59	
Balance available			$22,696 41
EQUIPMENT FUND.			
Appropriation (Act of April 1, 1897)		$2,500 00	
Disbursements		2,496 28	
Balance unavailable			$3 72
IMPROVEMENT FUND.			
Appropriation (Act of April 1, 1897)		$56,000 00	
Disbursements to date	$48,096 54		
Claims allowed (not paid)	3,306 85		
		51,403 39	
Balance available			$4,596 61
CONTINGENT FUND.			
Cash on hand July 1, 1898		$798 26	
Cash received		596 64	
Total		$1,394 90	
Disbursements		928 39	
Cash on hand			$466 51

REPORT OF PHYSICIAN.

To the Honorable Board of Trustees of the Preston School of Industry:

Gentlemen: I herewith submit to you for your kind consideration the following report of the Hospital Department, which has been under my charge from February 9, 1899, to the present date:

The soil is composed chiefly of débris of granite sand with very little loam, with hardpan of iron carbonate underlying. The geological formation is the primitive rock. Toward the west and northwest there are sandy plains covered with hard pine chiefly. The surface is hilly, with little or no swamp lands. The average height of inhabited lands above the sea-level is 450 feet.

We have been comparatively free from pulmonary diseases. Pneumonia appeared in one case only, which responded favorably to treatment.

Several epidemics, viz: those of parotiditis, tonsilitis, and typhoid fever, occurred, with negative results, all of the cases recovering.

Three deaths have occurred: Cadet Frank Ward, dying of paralytic dementia; Cadet Wheeler, succumbing to an attack of malignant remittent fever; Cadet Woolrich, dying of acute cerebral meningitis.

The prevailing diseases during the year were remittent and intermittent fevers. By the judicious use of quinine, etc., I succeeded in keeping the hospital free from lingering cases, none of the malarial cases remaining from school or work more than four days on an average.

The water-supply at present is not of the best. I earnestly advise that some means of obtaining pure water be devised, either by a new base or by filtration. The latter, I will suggest, might be accomplished by using a Hyatt filter, which coagulates the impurities and then filters them. The apparatus consists of tanks filled with sand, gravel, and coke. Provision is made for thoroughly washing and cleansing the filter bed as often as necessary, so that a bright, clear water of standard purity is guaranteed by its use. For further information see 49th Congress, 1st session, Senate Ex. Doc. No. 54.

It being now recognized that the protective influence of vaccination is not always permanent, and smallpox being in the near vicinity, I had all the boys in the institution re-vaccinated.

I mention this fact to emphasize the necessity of a separate building for hospital purposes. Should smallpox gain an entrance, we could hardly expect to combat the disease successfully, as the facilities for isolation are at present inadequate. The room now used for hospital purposes is situated on the third floor and is reached by stairs only. The operating-room is used for many purposes besides surgical work. Suspected cases are kept under observation in the room; also contagious diseases, when unfortunate enough to appear, are placed therein.

Quite a number of surgical cases of a minor character have been operated on with good results, among them being the removal of an osteoma of the lower jaw.

Below you will find a tabulated report of the cases, both surgical and medical, treated in the institution.

Abscess	5	Furuncle	10	Osteoma (lower jaw)	1
Acne	2	Gastritis	3	Odontalgia	26
Anæmia	1	Gonorrhœa	20	Paralytic dementia	1
Anerexia	5	Heart palpitation	1	Parodontides	24
Asthma	1	Hemorrhoids	2	Paronychia	4
Bronchitis	2	Hernia	2	Pleurisy	1
Catarrh (nasal)	6	Incised wound	21	Pneumonia	1
Conjunctivitis	1	Indigestion	1	Poison oak	3
Constipation	1	Insomnia	1	Proctitis	1
Coryza	25	Itch	5	Rheumatism	2
Cramps	10	Laryngitis	1	Ringworm	7
Croup	1	Lumbago	2	Scalp wound	6
Cystitis	2	Lymphadenoma	1	Sciatica	1
Debility (general)	1	Malaria	150	Scrofula	2
Diarrhœa	15	Malignant remittent fever	1	Syncope	2
Eczema	2	Meningitis	1	Syphilis	1
Ecchymosis eye	4	Neuralgia	4	Tonsilitis	11
Epistaxis	2	Neuritis	1	Typhoid fever	8
Fractured bone	2				

F. D. TYRRELL, M.D.

NINTH BIENNIAL REPORT

OF THE

Bureau of Labor Statistics

OF THE

STATE OF CALIFORNIA,

FOR THE

YEARS 1899-1900.

F. V. MEYERS, : : Commissioner.

SACRAMENTO:
A. J. JOHNSTON, : : : : : : : SUPERINTENDENT STATE PRINTING.
1900.

Bureau of Labor Statistics,
State of California.

Hon. Henry T. Gage, *Governor of California:*

Sir: I have the honor to submit to you herewith the Ninth Biennial Report of this Bureau, covering the years 1899 and 1900.

Very respectfully yours,

F. V. MEYERS,
Commissioner.

INTRODUCTION.

The work of this Bureau, carried to completeness, covers a large and exceedingly varied field, while the authority and means possessed by those connected therewith for accomplishing the said work are but limited. To well gather the industrial statistics of the State, and thereafter to tabulate and present biennially in a report, in an intelligent manner, such statistics, as contemplated by the Act creating the Bureau, require a larger staff of assistants, and a more liberal appropriation, than the Bureau has been provided with thus far.

In addition to the statistical work named, statutes enacted from time to time have added other work to the Bureau, such as inspection of industrial establishments, and the enforcement therein of laws relating to the safety, health, and comfort of employés. And still again, other work has, by legislative mandate or by custom, grown to be part of the work of the Bureau; such, for instance, as the investigation of complaints by working people of wrong or injustice suffered by them at the hands of employers or others, and the righting of the wrong or injustice complained of, when it is found to exist, as far as within the power of the Bureau so to do.

My predecessors, almost without exception, have called attention to the failures which usually follow attempts to collect data by correspondence. Those possessed of the information sought for in such cases, and to whom inquiries are addressed, as a rule neglect to make reply. This neglect arises, in some cases, from simple indifference; in others, from resentment toward what is deemed to be interference with private affairs; and in others, still again (happily in but few cases), from lack of disposition to oblige. Often, too, when replies are made, they are so incomplete as to be of no statistical value.

By law it is made the duty of various State and County officials to, upon due request, furnish all information within their possession, or reasonably within their power, relative to matters with which the work of the Bureau deals; but here, again, the results of correspondence are unsatisfactory. It is true that inquiries addressed to State officials have in most cases brought courteous replies, and information where possible for them to furnish it, and the same has often been the case as regards county officials and officials of cities and towns; and I wish all who have thus replied to feel that I here express to them, individually,

my appreciation of their kind courtesy in so doing; and yet the fact remains that a large percentage of such inquiries received no replies, and of the replies received a large percentage contained but incomplete data or none at all. All this prompts me to join with my said precedessors in the opinion that statistical information of the kind in question can be gathered satisfactorily and accurately only by going, or sending some one, in person to each locality and establishment, and making necessary inquiries direct.

When, on September 7, 1899, I assumed the office of Commissioner of the Bureau, viewed the work to be accomplished, including preparing and publishing this report, and marshaled the ways and means at my command for the accomplishment of the said work, I found myself at even greater disadvantage than had been my precedessors in most cases at the beginning of their terms; because,

(1). While under the law creating the Bureau $4,500 per annum may be allowed for the hire of assistants, traveling and contingent expenses, etc., the appropriation per annum for the first two fiscal years of my term equaled but $2,500; the same being less, with but one exception, than had been before allowed in any case to the Bureau during any one year for the purposes named, since its creation.

(2) My predecessors had in no case assumed office later than April in the first year of their term, and thus had not less than one year and a half in which to prepare their first report, with proportionate part of the revenue of the Bureau for use for such purpose. I, on the other hand, did not assume the office until September of the said first year of my term, and hence had but slightly more than one year in which to gather data and prepare this report; and the revenue of the Bureau, expended between April and September of the first year of my term, has been of no use to me whatever in such work, since when I assumed the office I found no data therefor gathered or on file.

(3) My predecessors have, in most cases, been unrestricted in the matter of printing. I found myself with a specific appropriation of $1,750 for printing for the Bureau, out of which must come the cost of all printing (including the cost of printing this report) ordered for the Bureau during the two current fiscal years. I was early notified by the State Printing Office that the said amount would not permit much expense in the way of forms or circulars for gathering data, and that any report printed would have to be as economically prepared as possible in order to be within the appropriation.

None of this explanation is in a spirit of complaint. Those upon whom rests responsibility for the proper and economical distribution and disbursement of the revenues of the State have deemed it wise, in view of all considerations forced upon them, to limit the means of the Bureau as described, and I have deemed it my proper part to simply do the

most and the best possible with the means at my command, and this explanation is only to show that if large results do not appear, the reason therefor has not been for lack of diligence or of cheerful willingness.

In its original conception this Bureau was created in the belief that it would in a degree be an exponent and protector of the rights and interests of the wage-earners; that it would be a department of the State government in close and intelligent sympathy with their affairs, to which they might turn for advice and information, and for such assistance as could be consistently rendered to them. This being the case, it would seem logically to follow that the administration of the Bureau should be in the hands of such as come from wage-earners themselves, and who are conversant, by reason of personal experience and association, with those subjects with which the work of the Bureau deals. Plain, however, as this proposition seems to be, it has remained for our present Governor, Henry T. Gage, to be first in this State to take official cognizance of it; and while the excellence of his choice for the office of Commissioner may well be considered a debatable matter, his sympathy with the originally conceived idea of the plan and scope of the Bureau is shown by the fact that its entire staff, under his administration, have come to their respective places direct from among the wage-workers of the State.

Speaking in some degree understandingly, I have felt that wage-earners, turning to a report of this Bureau, will feel most interest in those things which come close to their immediate daily life and wants; in those things which tend to show to them their own condition as compared with the condition of wage-earners in other places; in those things which will assist them to judge understandingly of the chances for obtaining employment; in those things which give them information regarding the laws which directly affect their rights and interests as workers, and which suggest remedies (where reasonably possible) for real evils to which they are subjected. With all the foregoing in mind I have worked, with the able and well-appreciated assistance of Deputy Commissioner J. D. Kelsey, and of Special Agents E. L. Reguin, K. Zwicker, and (temporarily) Mr. W. Macarthur, with results as found in part on the pages following.

STATE PRISONS, COUNTY JAILS, REFORMATORY INSTITUTIONS, AND CONVICT LABOR.

The average aggregate number of persons confined at any given time during the past year in the State prisons and reformatories, and the County jails of California is 3,601, segregated as follows:

San Quentin Prison	1,296
Folsom Prison	890
Whittier State School	295
Preston School of Industry	124
Jails of the respective counties	1,006

The competition of the labor of these prisoners thus confined, with the free labor of the State is, and has for some time been, kept at a minimum, being expended in great part on the internal maintenance and conduct of the respective institutions themselves; although a portion of those at San Quentin continue to be employed in the manufacture of jute bags, and a portion of those at Folsom to be employed in the crushing of rock for road-macadamizing purposes.

At San Quentin, during the early part of the year 1900, prisoners were employed as follows:

Labor Report for March 14, 1900.

NON-PRODUCTIVE CLASS.	No. Empl'yd.	PRODUCTIVE CLASS.	No. Empl'yd.
Warden's Office	1	Jute Department	711
Captain of the Yard's Office	8	Engineers' Department	3
Clerk's Office	2	Foundry Department	25
Captain of the Guard's Office	2	Stock Department and Stable	14
Commissary Department	8	Female Department	25
Laundry Department	33	Wheelwright Shop	2
Library Department	5	Upholsterer Shop	2
Barber Shop	11	Locksmith Shop	1
Shoe Shop	17	Carpenter Shop	12
Tailor Shop	22	Plumber Shop	2
Lamp-lighters	2	Cooper Shop	1
Bath-tank Tender	1	Paint Shop	3
Cell and Room Tenders	31	Tin Shop	6
Gate and Door Tender	13	Coal Yard	1
Hospital Nurses	7	Vegetable Gardens	9
Sweepers	8	Flower Gardens	11
Scavengers	35	Belt-makers	1
Whitewashers	3	Improvements	1
Gen'l Kitchen and Dining Room	71	Stevedores	14
Outside Kitchen	19	Road Gang	22
Hospital Kitchen	2	Chicken Ranch	1
House Servants	25	Hog Ranch	3
Electricians	1	Blacksmith Shop	4
Photographers	2	Harness-makers	0
Messengers	2	Ranch Gang	0
Guards' Department	5		
		Total	874
Total	336		

Labor Report for March 14, 1900—Continued.

LOST LABOR.	No. Empl'yd.	RECAPITULATION.	No. Empl'yd.
Cripples and insane	32	Productive class	874
Doctor, daily excuses, dungeon, etc.	25	Non-productive class	336
Patients in Hospital	20	Lost labor	86
To be executed	6	Total	1,296
Unemployed	3		
Total	86		

Interesting in connection with this may be a statement of the profit derived by the State from the sale of jute bags manufactured as stated above, viz:

Year ending June 30, 1894	$28,408 60
Year ending June 30, 1895	6,670 56
Year ending June 30, 1896	12,288 45
Year ending June 30, 1897	25,991 87
Year ending June 30, 1898	12,855 95
Year ending June 30, 1899	59,568 73

It is by no means likely that the manufacture of these bags could be carried on successfully with free labor within the State, even if their manufacture at San Quentin were discontinued, since the material of which such bags are made is not produced here, and free labor would have to compete in such work with the cheap labor of the Orient, where such material is produced and such bags are extensively manufactured by the native labor there.

At Folsom Prison, during the early part of 1900, prisoners were employed as follows:

Avocation.	No. Employed.	Avocation.	No. Employed.
Rock-Crusher	194	General Laborers in Quarry	70
Improvements around Prison	164	House Servants	13
State Power-House	9	Hospital Nurses	3
Barber Shops	5	Harness Shop	1
Blacksmiths	29	Laundries	27
Chicken-Ranch	1	Library	2
Captain of the Guard's Office	14	Lamp Room	1
Cell Tenders	26	Officers and Guards' Mess	10
Commissary	8	Prison Mess	48
Carpenter and Wagon Shop	9	Plumber Shop	2
Dairy	2	Paint Shop	3
Engineers	2	Photographer	2
Flower Garden	24	Ranch	12
General Overseer's Office	4	Road Gang (R.R. track)	11
Gate Tenders	8	Sawmill	5
Bookbinders and Upholsterers	2		

In the quarrying and crushing of rock for the road purposes named, we can readily believe that free labor is to some extent displaced, although probably not to any considerable degree, since it is likely that

the increase in the price of such road material would stifle the demand for it, and without such increase in price free labor could not be employed in its manufacture.

In the Whittier State School the inmates are taught industrial trades to some extent, such as baking, blacksmithing, carpentering, electrical engineering, farming, gardening, cooking, laundry work, painting, printing, shoemaking, and tailoring. Nothing is manufactured for outside sale. The work of inmates is employed in assisting to maintain and conduct the internal affairs of the institution.

The Preston School of Industry is conducted upon the same general plan as the Whittier, as regards trades taught, work done, etc.

Of the 1,000 prisoners confined on an average in the county jails, only about 100, according to reports received, are required to do any work outside the jails in which they are confined; and the labor done by those who do work outside is usually on public grounds, or around the jail yards, or on the public streets or county roads. Various reasons are given for not employing these prisoners more extensively. In some cases it was said that the cost of guarding them while at work more than offsets the advantage gained by working them. In other cases it was said that no funds were available with which to employ guards; and in still other cases it was said that any attempt to extensively employ them outside of the jails would be strongly objected to by the free labor in the vicinity; as, for instance, the following plaintive response from the Sheriff of a certain county, viz: "Working prisoners was tried in this county, but so much complaint came from the laboring classes that it was done away with, or rather we never started in. I have always found strong opposition to working them. If I take one out to work about the courthouse grounds, a mob of idle taxpayers soon appear and claim that the work should be given to them."

The cost per capita per diem to the State for the maintenance of prisoners in San Quentin is about 37.9 cents; in Folsom, about 34½ cents; in the Whittier State School, about 91 cents, and in the Preston School of Industry, about 85 cents. The cost per capita per diem for the maintenance of prisoners in the various county jails ranges all the way from 20 to 75 cents. The figures given, of course, do not in any of the cases named include any expense other than the mere cost of the maintenance itself; the cost of the prison plant, and the betterment and maintenance of the same, being an entirely separate matter. Some of the counties report a surprisingly low cost per diem for feeding the prisoners in their jails. One Sheriff reported that such per capita cost is but 25 cents. Further along in his communication he innocently remarked that they seldom have prisoners in their jail, which fact did not appear to me to be phenomenally singular under the circumstances.

It is apparent from all the foregoing that, so far as the prison labor of

California is concerned, the free labor of the State has little to fear in the way of competition; but, unfortunately, it would appear that the same cannot be said as regards the prison labor of other States. From data secured through the medium of various reports, and from personal inquiry where possible, it would seem that this phase of the question of prison labor has not heretofore had the attention which its importance deserves. A large number of the State prisons of the United States manufacture articles of different kinds and send them into this State to be sold in direct competition with the labor of our wage-earners. The labor of the inmates of the State Prison of Oregon, at Salem, is used in the manufacture of stoves, which have been until recently quite extensively sold in the California markets. Some of the labor organizations, and the Manufacturers' Association of San Francisco, made strenuous objection, however, with the result that such stoves are now but little sold here, only a few houses in the interior being said to be handling them.

The inmates of the Washington Penitentiary at Walla Walla manufacture jute goods, and bricks; but these are not shipped into this State to any considerable extent, so far.

The inmates of the Illinois State Prison at Joliet are engaged extensively in manufacturing. Something like thirty different kinds of manufactured articles are produced by them, which include shoes, harness, saddles, hose, collars, hosiery and knit goods, cigars, brooms, rattan and reed ware, cooperage, cane seats, cut stone, iron and brass goods, etc. One of the most extensive of their manufactures consists of chairs, the most of which are said to be sold in this State.

The inmates of the State Prison at Michigan City, Indiana, are employed under the contract system in the manufacture of boots and shoes, chairs, coopers' wares, knit goods, gloves and mittens, and bicycles; and the State of Indiana receives quite a revenue from the contract labor of these inmates.

The inmates of the State Prison at Jeffersonville, Indiana, also work, under contract, in the manufacture of "hollow" ware (tinware), saddle trees, brushes, wire goods, etc. Some two hundred men are thus engaged in the manufacture of tinware alone; and it may here be noted that it is said that ninety per cent of the tinware made in the United States is made by the inmates of the various State prisons.

The inmates of the State Prison at Fort Madison, Iowa, manufacture farming implements and chairs under contract.

The inmates of the State Prison at Frankfort, Kentucky, make chairs, some of which are said to find a market in California.

The inmates of the Branch Prison at Eddyville, Kentucky, make brooms, spokes, and ladies' shoes, which are said to be shipped broadcast over the United States.

The inmates of the prison at Thomaston, Maine, manufacture carriages, harness, and brooms.

The inmates of the State Prison at Baltimore, Maryland, manufacture, under contract, boots, shoes, hollow ware, furniture, and plumbers' marble.

The inmates of the State Prison at Charleston, Massachusetts, are employed in the manufacture of shoes, harness, brushes, trunks, rattan chairs, and shirts.

The inmates of the State Prison at Jackson, Michigan, manufacture, under contract, wagons, agricultural implements, stone work, boots and shoes, and at the prison itself they manufacture brooms, boxes, and shooks.

The inmates of the State Prison at Stillwater, Minnesota, manufacture boots and shoes under contract, and at the prison itself they manufacture binding twine and woodenware.

The inmates of the State Prison at Trenton, New Jersey, manufacture, under contract, hosiery, mats and matting, block brushes, shirts, pants, and shoes.

The inmates of the State Prisons at Sing Sing, Clinton, and Auburn, New York, were, until 1897, engaged in the manufacture of clothing, furniture, chairs, woodenware, harness, saddles, hollow ware, brushes, etc., but since 1897 such manufacturing has been discontinued.

The inmates of the State Prison at Bismarck, North Dakota, make harness.

The inmates of the State Prison at Columbus, Ohio, make bolts, chairs, and cigars, under contract.

The inmates of the State Prison at Alleghany, Pennsylvania, manufacture mats, hosiery, brooms, and shoes.

The inmates of the State Prison at Howard, Rhode Island, make, under contract, boots and shoes, also harness.

The inmates of the State Prison at Nashville, Tennessee, make saddlery and iron ware.

The inmates of the State Prisons at Rusk and Huntsville, Texas, and of the State Farm at Harlem, Texas, manufacture a great deal of iron work. At the Rusk prison there is a blast furnace, iron foundry, pipe foundry, and machine shop. The main output is cast-iron water-pipe. Other articles of manufacture are seamless thimble skeins for wagons, sad irons, and sash weights. Boilers and pig iron are also made. Both prisons have a sawmill, with a capacity of forty to fifty thousand feet per day. A great deal of the lumber here made is used at the Huntsville prison in the manufacture of furniture and wagons.

The inmates of the State Prison at Richmond, Virginia, manufacture shoes and tobacco.

The inmates of the State Prison at Moundsville, West Virginia, are

reported as engaged in manufacturing, but no statistics are given as to articles manufactured.

The inmates of the State Prison at Waupun, Wisconsin, make shoes, and tailors' and knit goods.

The foregoing is as complete a presentation as the data at hand will permit of, of the list of the several State Prisons where manufacturing is carried on, and of the articles thus manufactured for sale. It is most difficult, as matters now are, to say in many cases with positiveness just what goods sold in this State are the product of some of the prison labor named. Those who deal in such goods naturally do not advertise the fact. Reason, however, most clearly maintains that such manufactures are not regularly carried on, as appears, without the articles thus made being as regularly disposed of in the markets somewhere, and there is no consistent reason for believing other than that a large quantity of them find their way into the markets of our State through the regular channels of trade, to the detriment of our manufacturing interests and of our free labor. It is true that in a few cases the laws of the State where such goods are made, as described, require them to be stamped or marked in such a way as to indicate that they are prison-made; but these cases are not many, and, on the other hand, it is usually the case that the prison labor is simply hired by some contractor, who furnishes the raw materials and pays for the labor required to do the manufacturing, and these contractors can, of course, dispose of the goods in the general markets the same as any other manufacturer; thus coming in direct competition with the free labor of other States.

Under the present status of our laws there seems to be nothing to prevent the sale in California of the goods and wares described. Some of the States prescribe by legislation for the labeling or marking of all such prison-made goods when exposed for sale in the markets, in such a way as to reveal that they are prison-made, and such legislation, duly enforced, doubtless would do much toward lessening the evil. A seemingly more far-reaching and effective remedy would quite likely be the final passage of the bill introduced into the lower house of Congress at its last session by the Hon. Julius Kahn, Congressman from the Fourth Congressional District of this State, which bill passed the said lower house, and which provides, in substance, that goods, wares, and articles of any description, manufactured by prison labor in any State, shall be permitted to be sold only within the State in which they are made. It is to be hoped that this measure will become a law.

As repeated in other places: Any agency which tends to lower the wage of the wage-earner to an amount less than it might otherwise be maintained at, without in its effect stifling enterprise in the industry in which it is employed, menaces the ultimate welfare of all the people.

ORPHAN ASYLUMS, AND INSTITUTIONS FOR THE DEAF AND BLIND.

In California there are some thirty-nine orphan asylums which receive State aid, more or less. The inmates of these asylums number, in the aggregate, on an average, about 5,480; of which about 2,769 are males, and about 2,611 are females. Their ages range all the way from a few days to sixteen or seventeen years; there being, however, but 8 males and 106 females who are above the age of sixteen.

The aid given by the State to these institutions varies somewhat, it reaching all the way from 20 to 40 cents per inmate per diem; usually, however, averaging close to 27 cents.

In some of the asylums the children are, when old enough, taught housework, nursing, sewing, cooking, garden work, and, in a few instances, trades, such as shoemaking, millinery, dressmaking, printing, tailoring, and engineering. In no case is the product of their labor sold on the market, it being consumed in conducting the respective establishments.

There is at Berkeley in Alameda County, this State, an Institution for the Education of the Deaf and the Blind maintained by the State; the inmates of which aggregate, on an average, about 212, of which 51 are males over sixteen years of age, 75 are males under sixteen, 36 are females over sixteen, and 50 are females under sixteen. Comparatively few are retained as inmates who are above the age of eighteen years. These inmates are taught, as a rule, to do domestic work and some gardening, and also in some cases trades, such as wood-working, printing, dressmaking, etc. Nothing, however, is sold in the market, all articles produced being consumed in the establishment itself. The cost to the State for the maintenance of these inmates averages about 75 cents per capita per diem.

There is at Oakland, California, an Adult Blind Asylum; the inmates of which number about 92. Of these inmates 73 are males, and 19 are females. The cost to the State for their maintenance averages about 50 cents per capita per diem. There is at this institution a broom factory, which, however, is not being operated at the present time. The labor employed in the same when it is operated is that of the inmates. These inmates are also employed to some extent in reseating cane-bottom chairs. The articles named as being made and repaired by them are

sold on the markets, and the revenue derived therefrom is divided among those inmates who perform the labor.

From the foregoing it will be seen that from the inmates of the institutions named the labor of the State has scarcely any competition.

ALIEN LABOR IN THE STATE OF CALIFORNIA.

Prior reports of this Bureau have noted that, owing in great measure to the "Exclusion" laws, the question of Chinese labor in California had lost much of its importance, and the same continues to be true. Neither general report, nor yet specific investigation, as made where possible, reveals increase in the percentage of such labor employed in any avocation, while on the other hand material decrease in such percentage is often shown. And again, it should perhaps be noted that the tendency during the past number of years has been toward increase in the wage demanded by that class of labor. Relieved, by the operation of the Exclusion Acts, in great measure from the pressing competition of his fellow-countrymen, the Chinese worker was not slow to take advantage of circumstances and demand in exchange for his labor a higher price, and, as time went on, even becoming Americanized to the extent of enforcing such demands in some cases through the medium of labor organization; and hence, as said, the question of his competition with the other labor of the State lost much of its importance. This is not by any means to be construed as saying that Chinese labor has been eliminated from the industrial avocations of the State, but only that its percentage is less than formerly, and that therefore it has ceased to be prominent.

During the past few years, however, the increase of the immigration of Japanese labor into the State has given great concern to the public at large; and this concern gave place to positive alarm during the year 1899 and the early part of the present year, 1900, caused by the very pronounced increase of such immigration within the last said time. Believing the subject to be of great interest to the people of the whole State, I have endeavored, as far as ways and means have permitted, to gather reliable information regarding it, and the result of such endeavor will be found herein. It is proper to say in this connection that I have tried to present simple facts; believing that in all such matters the

people are best served when, in a report such as this, things are described to them as they actually exist where that is possible; or where conclusions must be drawn from evidence, that they be simply such as the evidence reasonably justifies.

The United States census of 1890 reported 1,224 as the number of the Japanese population of California. Through the kindness of United States Immigration Commissioner North the following figures have been furnished to the Bureau relative to the number of Japanese coming into the State since that time; that is to say:

	Males.	Females.	Total.
From July 1, 1890, to July 1, 1891	984	118	1,102
" " " 1891, " " " 1892	1,382	36	1,418
" " " 1892, " " " 1893	896	65	961
" " " 1893, " " " 1894	786	59	845
" " " 1894, " " " 1895	484	23	507
" " " 1895, " " " 1896	523	38	561
" " " 1896, " " " 1897	725	47	772
" " " 1897, " " " 1898	768	58	826
" " " 1898, " " " 1899	1,547	120	1,667
" " " 1899, " " " 1900	2,657	107	2,764
	10,752	671	11,423

In addition to the foregoing figures, data obtained through the same courteous source reveal that, during the year 1898 there came into the State "by card" from Victoria, 348; during the year 1899, 274; and during 1900, up to September 1st, 1,000 Japanese; or a total of 1,622, which, added to the 11,423 and to the 1,224 before noted, gives a total of 14,296 in the State. This, however, includes no estimate of the number who may have come into the State from Victoria prior to April, 1900, as before said time no record of such arrivals was obtainable; nor does it include an estimate of the number who, during the time named, may have come into the State overland from British Columbia. No doubt a number have thus come, although in my opinion the most of those who come into the United States in that way do not reach California, being scattered through Oregon, Washington, Idaho, and the States of the Northwest generally, not coming as far south as our State. Again, the total given makes no allowance for native-born Japanese; and while this feature of their presence has scarcely yet been noticeable, the fact remains that as a race they are much more domesticated here than are the Chinese, many having families, and that in time the native-born among them will be a material addition to their numbers. On the other hand, however, no allowance is made in the said total for death and departure during the last ten years; things which must to some extent at least have occurred; and so, carefully estimating, I feel that to place the total number of Japanese in the State at this time at from 15,000 to 16,000 is conservative from any standpoint.

The figures foregoing show a sudden and large increase in the number of arrivals beginning in 1898. Following is shown the monthly number of arrivals beginning with January, 1899, and ending with August, 1900:

In 1899.

Month.	Males.	Females.	Total.
January	59	3	62
February	87	7	94
March	194	21	215
April	315	9	324
May	199	3	202
June	181	15	196
July	145	21	166
August	214	16	230
September	83	5	88
October	100	4	104
November	41	4	45
December	79	1	80
	1,697	109	1,806

In 1900.

Month.	Males.	Females.	By Card from Victoria.	Total.
January	61	1		62
February	151	2		153
March	554	4		558
April	686	13	125	824
May	423	14	300	737
June	120	22	184	326
July	61	10	169	240
August	95	11	113	219
	2,151	77	891	3,119

While these latter figures would seem to justify the alarm felt, as stated, during 1899 and the early part of the present year, they show a material falling off in the number of Japanese arrivals during the last several months.

In a study of this subject, an important question should have consideration, viz: What percentage of the entire alien immigration into the State, during the period named, does this Japanese immigration amount to? If it be shown that it constitutes the major portion of such immigration, that Japanese immigration has increased materially while other immigration has remained normal or has become less, the seriousness of the situation is enhanced. On the other hand, if it be shown that all alien immigration into the State was normal during the time named, there is ground for the belief that the increase in Japanese immigration was but temporary, and induced by some transient cause, such, for instance, as the generally advertised belief during the past year or two that trade and business were prosperous generally in this State, and that employment and good wages were easy to obtain. I merely direct

attention to this question. Unfortunately, I have not at hand data from which to answer it as regards the two years last past; but that, as a rule, in the past, European alien immigration into the State has been far in excess of Asiatic immigration is shown by the report of the United States Commissioner-General of Immigration for the year ending June 30, 1897, wherein is stated that during the said year the total number of European alien steerage passengers landed in the United States and Canadian ports whose destination was California was 3,392, while the number of such Asiatic aliens thus landed and destined was but 1,194, of which 10 were Chinese and the rest Japanese. Of the European aliens named, Ireland furnished 296, England 329, Germany 290, France 228, Switzerland 212, Portugal 223, Sweden 132, Italy 1,215, and various countries the remainder.

I made considerable effort to ascertain the reason for the abnormal increase in the number of Japanese arrivals during the early part of 1900, with result that three reasons that seemed in some degree plausible were advanced, viz:

(1) The generally advertised prosperous condition of the country, and reported demand for labor, which naturally stimulates immigration.

(2) That emigration-recruiting agencies in Japan had booked a large number of Japanese emigrants for Honolulu; that about the time they were aboard ship the bubonic plague, with its resulting quarantine, etc., appeared at that place and stopped the sending of the emigrants there; and that the agencies named, rather than surrender their commissions, induced the emigrants, in most cases, to change their destination from Honolulu to San Francisco; and in this connection it will be noted that the time of the coming of the largest number of Japanese per month was coincident with the time of the prevalence of the said plague in Honolulu, as said, or shortly thereafter.

(3) That, taking advantage of supposed favorable conditions, emigration agencies in Japan were extremely active in fostering the exodus of Japanese to California and other American ports, for the sake of accruing commissions.

Now, as to the cause of the sudden decrease in the said arrivals, which became apparent about May and June, 1900. It seems authoritatively to be stated that it has been in large part due to the action of the Japanese Government in restricting the departure of its subjects for American points.

The impression is very prevalent that the major portion of the Japanese latterly coming to the State, come here as "contract" labor; and yet, however this in fact may be, I am forced to say that, after most careful inquiry, it has been impossible to find tangible evidence to support the impression, although some evidence appears in support of the proposition that many come under the term "assisted" immi-

grants. A "contract" laborer, as contemplated by the laws of the United States, is one who by the terms of his contract is bound to the service of some particular person, and is subservient to the orders or to the will of that person for a definite or indefinite time, as the case may be, after his arrival in this country, in all matters relating to his service and the terms thereof. The "assisted" immigrant of whom I speak is one who has made himself responsible to some other person for a debt (possibly for the money which brought him here), and which he obligates himself, with third parties as sureties, to pay; while he remains free to come and go at will, so far as his service and employment may be concerned. One of these contracts, a copy of which I have seen, is between a company in Japan and a prospective emigrant for San Francisco, and in addition to its reference to money or assistance furnished, obligates the company to assist the return of the emigrant to Japan in case he becomes sick or destitute in America; the contract to run for three years, and the sureties being responsible for all advances made to, and expenses incurred in favor of, the emigrant by the company.

Of interest in connection with this subject generally is the following testimony, given under oath by an educated Japanese who conducts an employment agency in San Francisco:

JAPANESE LABOR.

April 12, 1900.

Mr. ———, being first duly sworn, testifies under oath as follows:

Mr. Meyers: Q. What is your name? A. ———.

Q. You are from the ——— employment agency at ——— Street? A. Yes, sir.

Q. Are you a partner in that employment agency? A. Yes, sir.

Q. How many other partners are there? A. Three, altogether.

Q. What interest have you? How much of the money belongs to you? A. I think one third.

Q. Suppose you took in $100, how much would you get? A. One third.

Q. How long has that employment agency been in existence? A. Three years.

Q. How long have you been a partner in it? A. About two years.

Q. How long have you been in California? A. About ten years.

Q. Did you come direct from Japan? A. Yes, sir.

Q. From what part of Japan? A. Tokio.

Q. Have you relatives there? A. Yes, sir.

Q. What relatives? A. Parents, sisters, brothers, etc.

Q. How old were you when you came here? A. About twenty.

Q. What was your object in coming here first? A. To study English and to see the customs and manners of this country, thinking I would then go back home and teach them. I think I will go back in a few years. My intention in coming was to learn things so as to improve my countrymen at home.

Q. Are your parents wealthy? A. They are in comfortable circumstances.

Q. What occupations do they follow? A. Merchants, artists, etc.

Q. Had you learned any trade or occupation in Japan before you came here? A. Yes, sir; after I got through the Japan grammar school I was taken by my uncle to help him in business, in a drygoods store, as a clerk and salesman.

Q. What wages did you receive? A. Not any wages, as he was my uncle. Every salesman was not paid at that time; a merchant always took one from his own family into the store.

Q. Did no salesman get salary? A. No; they were taken care of, etc.

Q. Suppose you went into anybody else's store, would you have got any salary? A. No, not then even, but was considered as a sort of servant. They are expected to stay three, five, or ten years, and then would get something. Some wealthy merchants would let a faithful clerk open a store for himself at their expense.

Q. After a man has learned the run of a store, what wages would he ordinarily get? A. I cannot tell.

Q. You cannot convince us that if your father had a store and your uncle had a store that you do not know? A. My father had five sons.

Q. Did you not work in your father's store? A. We go to other people's stores.

Q. You say that your father had five sons? A. No, they were all hired.

Q. What did he give them? A. He would give them clothes, take care of them, and give them what little spending money is necessary, until they were through with the years they promised to stay.

Q. How much do they get when they are through? A. Generally about 200 yens, between 200 and 400 yens, for about four or five years' service.

Q. Suppose he did not get anything? A. When he does wrong he gets nothing.

Q. Suppose you went to work in Japan for a relative and worked for him for five years for board, clothing, and lodging; if you kept on working for him after that, would he not pay you a certain amount of wages in addition to board? A. Some work in one place a whole lifetime, and after the years they promise to stay are up they then get about $1.50.

Q. Would they get that besides board, clothing, etc.? A. They may furnish a small house for him besides, and he may get a percentage of the sales.

Q. What does a carpenter get in Japan? A. About ten years ago 25 cents; skilled men about 75 cents. Since then wages have about doubled in Japan. Everything has gone up; a suit of clothes that cost $25 here you could have bought in Japan for $8 ten years ago, but such a suit now costs $15.

Q. What does a machinist get there, a blacksmith for instance? A. Same as carpenters.

Q. What does the farm laborer get? A. Do not pay day's wages; work in the same way as for merchants.

Q. Don't they get any wages on the farm? A. They get about 50 cents a day.

Q. What did they get about ten years ago? A. About 35 cents.

Q. For common farm labor? A. Yes; some are willing to work for 15 cents a day. They have only come under civilization the last thirty years.

Q. Does not a farm laborer in Japan work for 10 or 15 cents a day? A. Not now; may be ten years ago. Many of the laborers have emigrated to Formosa and Honolulu.

Q. Had you any relatives here before you came here? A. None.

Q. Any friends? A. Yes, sir.

Q. Did they write back and say it was a good place to come to? A. No.

Q. On whose information did you make up your mind to come here? A. Went to school there, read the papers, etc.

Q. Did your friends here ever write back to you? A. Yes, sir.

Q. Did your friends write that this is a good place to come to? A. Yes; saw several friends there who had been here.

Q. Who told you that it was a good country to come to? A. Yes; said there was plenty of money; very good place to learn English and everything.

Q. On that information you concluded to come here? A. Yes, sir.

Q. Who furnished you the money to come? A. My relatives.

Q. About how much did they give you? A. About $300; afterward sent money twice a year.

Q. About how many Japanese are there in California? A. I can only make a supposition; it is better to ask the Consul; three or four years ago there were about five thousand.

Q. Then there would be about ten thousand now? A. It may be more; the Consul would know.

Q. Does your Government require all Japanese coming to this country to go back?

Don't your papers require you to go back in three or four years, or get leave to stay longer? A. Yes, sir. Any that come here want to get back as quick as possible.

Q. Do the Japanese here now intend to stay here all their lives? A. Most of them do; some of them intend to go back, most like to stay, but at present they have no such privilege.

Q. You furnish Japanese help here? What particular kinds of avocations do you furnish help to ? A. Mostly to domestic service.

Q. Are there any Japanese shoemakers in California? A. Yes; quite a number.

Q. What wages does a Japanese shoemaker get in Japan? A. I do not know.

Q. You ought to have some idea as to what a Japanese shoemaker would get in wages after all your studying in Japan and here? A. I think about 75 cents to $1.

Q. Why should a shoemaker get more than a carpenter? A. Shoes are scarce there; only the higher classes wear shoes in Japan.

Q. What does a Japanese shoemaker get here per day? A. An experienced shoemaker gets about $1 per day.

Q. Are wages higher in Japan than here? A. No; lower.

Q. Are there many shoemakers here? A. Yes, sir.

Q. Where are their places of business? A. Valencia Street, in the neighborhood of Sixteenth; Webster Street, near McAllister, and Mission Street, near Eighth. There are about twenty Japanese houses here making shoes.

Q. Are there many Japanese here making clothes? A. Not many.

Q. Are there many Japanese carpenters here? A. No.

Q. Any Japanese watchmakers? A. About half a dozen.

Q. Where are they? A. Dupont, near Pine Street.

Q. What other avocations do Japanese work in? Any tailors? A. Yes, sir.

Q. Do you go to a Japanese store to buy your clothes? A. No, to a white store.

Q. Where is there such a tailor? A. On Geary Street or O'Farrell Street, near Union Square. There are two or three in that neighborhood, patronized mostly by white people.

Q. Any hat-makers? A. No.

Q. Do you furnish laborers for farms? A. Sometimes, if they need them, when we get letters from farmers.

Q. Who sends you letters? A. We have not had many up to now.

Q. Do you ever furnish men for orchards? A. Yes, sir.

Q. For sugar-beet raising? A. Not yet.

Q. Do you furnish labor to pick hops? A. Not yet; may this year?

Q. Why do you think this year? A. Because we are increasing our business.

Q. Did you ever hear of the Spreckels Sugar Refinery? A. I think so.

Q. Of the beet fields at Watsonville? A. Yes, sir.

Q. Who furnished Japanese for them? A. There is some one in the country who does that.

Q. Where do those bosses live? A. I don't know; at Fresno and other places.

Q. You say that most of the Japanese farm laborers are "green"? Why do you say "green"? A. Those that are not long from Japan.

Q. Then when they know more they leave? A. Yes, sir.

Q. Now, suppose you cannot get enough "green" hands? A. They get what they want; they cannot get a large number in the employment agencies at all.

Q. Where do they get them? A. They advertise in the Japanese papers.

Q. Where is this paper published? A. On Powell Street, near Sacramento; it is called the "New World"; there is also one published on Eighth Street, called the "North American News".

Q. Don't they ever put ads in the paper in Japan? A. No.

Q. Why not? A. You mean for collecting boys?

Q. Yes, like this summer, when there is to be so much to pick; hops, fruit, etc.? A. I don't think so.

Q. But don't the bosses, who want to fill these places and who advertise in the papers here, advertise in the papers in Japan? A. No, because it is very hard to get here; the Government watches those who come.

Q. It doesn't look like it? A. Most of them come to study; to get an education.

Q. But there were two hundred or more landed here from the "Belgian King"? A. I have heard that there was an unusual number.

Q. Why is it? A. The reason is that a great many laborers have been going to Honolulu, and an order has been issued that no more laborers can go there until the sickness at that place dies out. Some Japanese emigration societies promised to send the laborers to Honolulu, and when they could not be sent there they were sent here instead. The emigration societies get a commission from each boy, and do not like to pay it back.

Q. How much commission? A. $5.

Q. Who pays the commission? A. The boy.

Q. Did you pay any commission? A. No; I was not a laborer; I came by myself.

Q. For what is that commission of $5 paid? A. They take the boys to the ships, get papers for them, take their things to the ships, etc.

Q. Does any one in Honolulu send for the boys? A. The branch might have some communication with them.

Q. Do these boys just stand around there and wait until some one sends them here? A. No contract or anything like that is in existence; they like to come here.

Q. You say that these laborers that work in the sugar-beet business are usually furnished by bosses living in the country? A. They are men just working around; some come here in the winter and work at anything.

Q. How do you explain this fact? These laborers come here and say they are going to Watsonville; how did they know in Japan anything about Watsonville? A. I do not think that these laborers know where they are going. They have relatives here and some that go back tell about the country, and it makes them want to come. The population is increasing so rapidly in Japan that they begin to go elsewhere.

Q. You furnish principally house servants? A. Yes, sir.

Q. Did you ever furnish any one to work in mines? A. Yes, about eighty boys to Alaska.

Q. For what? A. Canning business.

Q. What were they to get? A. All expenses paid and $100.

Q. Their board and lodging? A. I think so.

Q. Did a boss go in charge of the eighty boys? A. One Japanese boss.

Q. What did he do? A. Supervised their work.

Q. Did they have to do whatever he said? A. Not necessarily.

Q. Suppose after working a month one concluded to leave, could he do so? A. I don't know.

Q. Who was the money paid to? A. To the boss.

Q. Did they pay him any commission? A. I don't think so; he had his own salary.

Q. What wages do the "green" Japanese get that go out into the country to work? A. I don't know, except for picking grapes.

Q. What do they get for picking grapes? A. From 75 cents to $1 per day; in piece work they make from $3 to $4 per day.

Q. You furnish any Chinese help? A. Yes, but not much.

Q. Do you furnish many Japanese cooks? A. Yes, sir.

Q. Are there many Japanese doing housework here? A. Very few.

Q. Any going out house-cleaning? A. Not many.

Q. Are there many Japanese employed as house servants here? A. Most of the Japanese that are in the city work as house servants.

Q. Of the house servants in San Francisco what percentage are Japanese? A. A small percentage; one out of every hundred.

Q. How many Japanese were employed as house servants five years ago? A. There are many more now.

Q. What has become of the Chinese house servants? A. There are more than there used to be.

Q. What wages does a Japanese house servant get here for chamber work? A. $15 to $25.

Q. For cooking? A. $15 to $40, including business places.

Q. Are there not a great many Japanese boys here who go to school and work in private families for their clothes and a few dollars per month? A. Yes, a great many;

about one fourth of all the Japanese here are school boys; one fourth of those who stay in the city.

Q. Do you ever write back to your folks in Japan? A. Yes, sir.

Q. What do you tell them of this country? A. Tell them of the bright side.

Q. Do you ever write to your brothers that this is a good place to come to? A. No; they have their own business there.

Q. Do the Japanese here encourage those in Japan to come here? A. I don't know. I don't think so; may be in some cases.

Q. Can Japanese do better here as a rule? Is there more money in business? A. Yes; in some lines. Laborers get more here and can save more. They can live cheaper here than in Japan, because there they help others and have social obligations.

Q. Do you know the Japanese boarding-house man at the wharf? A. Yes; he is disliked by the Japanese.

Q. Why? A. Because he would take too much money from them.

Q. Are there any hotels or boarding-houses in Japan? A. Yes, sir.

Q. What would a man going into a boarding-house in Japan have to pay? A. According to their mode of living.

Q. Now take this place on Brannan Street. How much would he have to pay in a place like that in Japan? A. $5 or $6. Everything is higher now. I paid $5 for board per month when I was going to school; a student who pays $10 per month is pretty well off.

Q. How much would he have to pay in this place at the wharf? A. About $10 per month, or $15 for the best room. It is not a very good boarding-house.

Q. Are there any good boarding-houses here? A. No.

Q. How much is paid for a night? A. 10 to 15 cents a night for a cheap bed.

Q. You think there are more Japanese house servants now than formerly? A. I think there are about twice as many.

Q. You think that the plague in Honolulu made more Japanese come here? A. Yes, I think that is the reason.

Q. For how long was your passport issued? A. I would have to ask the Consul to renew it.

Q. Does not your Government command you to come back or have your passport renewed? A. They sometimes stay without getting new passports. In my passports there is no time stated; came as a student. They are more strict with laborers; when they go back they are punished.

So far as evidence was obtainable, the process of securing Japanese labor for any purpose does not differ materially from that employed in securing desired labor of other kinds. The person seeking it, when unable to secure it by personal negotiation, simply gives an order to some person or agency who makes a business of supplying such labor, no doubt in consideration of a commission; although it is the rule for some Japanese to appear as boss or head-man, whose capacity seems often to be that of business manager for the laborers employed, he conducting negotiations regarding amounts due, number of men needed, etc., and receiving and distributing the wages earned. It appeared at times, too, that this "boss" was simply a contractor, as it were, or several were associated together as contractors, and they in turn employed and directed the rank and file of the laborers; it, however, so far as learned, appearing that when the particular work was done the laborers would disband and scatter, and their next work probably be under an entirely different boss, under different terms, and in some other place, all of which seemed to negative the suspicion that they were bound by con-

tract or otherwise to any one person as to their services. Interesting in this connection is the testimony of a gentlemen, as next appears, given under oath to the Bureau:

HOP-RAISING INDUSTRY.

MARCH 28, 1900.

——-, being duly sworn, testifies under oath as follows:

MR. MEYERS: Q. What is your name? A. ——.

Q. Where do you reside? A. ——.

Q. What is your occupation? A. Clerk; office work; also miner.

Q. You state having some knowledge of the employment of Japanese labor in this State? A. Yes, sir; in the hop fields and afterward under the management of the same people as the —— Sugar Company.

Q. Then —— are engaged in raising hops and also sugar-beets? A. Yes, sir.

Q. Give us some little idea of the process of raising sugar-beets and getting them to the sugar factory. A. We have just started in on the beet proposition. I went to the —— hop fields on the ——, and was made foreman of a Japanese gang of from 30 to 60 men; there were also Chinese working there.

Q. The first thing you saw of beet-raising was to plant them? A. Yes, sir.

Q. Who did the work of clearing? A. The Japanese. It took a gang of from 40 to 60 two or three months to clear 30 to 40 acres; there were also 30 Chinese and 2 white men working.

Q. That is as far as they got? A. Yes; just clearing this land.

Q. Are there any other fields? A. Yes, Portuguese fields, where the work is done by the owners or hired Portuguese.

Q. Give us some idea of the hop fields? A. There were 250 to 300 acres planted to hops. They start in January or February to take away the dirt from the hills and cut off all the useless limbs; this they call suckering. In the first place they have big poles 16 to 20 feet high that are planted into the ground at regular intervals apart; across the tops of these poles they extend a network of wire, and above each plant a thick string is tied to the wire above and to the lower end of the string is tied three other strings that reach down to the plant. The dirt is taken away from around the plant and the old limbs cut away and then the dirt is replaced. Then when they go over it again they tie the new shoots to the strings and train them to grow up.

Q. How many days' work would it take to fix one acre? A. I did not see them do that. I think it took 25 or 30 Japanese 30 or 40 days to fix 250 acres.

Q. Did you learn if they ever had employed any other labor than that? A. Several years ago they employed white labor; boys and girls.

Q. Why did they give up the white labor? A. I suppose they got cheaper labor.

Q. Do you know that that is the cause for changing? A. I do not know.

Q. Did they have any difficulty in getting the white labor? A. I do not know.

Q. They start in January or February and have about a month's work fixing the plants? A. Yes; taking the dirt away from the roots, cutting away the useless limbs, and then putting the dirt back again. Then when the young shoots start out again the Japanese tie them to the strings.

Q. Don't they in certain seasons take down the poles? A. No, not the poles.

Q. First is the stringing, then the suckering about the same time? A. No; it takes a good deal longer to sucker them.

Q. What then? A. They then come back and tie the little new vines to the strings; then in May they scrape down the lower leaves; they keep training the vines up and trimming off the extra arms in order that the higher branches may have more strength; then they hoe and dig around the roots. They have white men handle the machinery and drive the horses. The Japanese contracted for $15.50 per acre to do all the work up to picking time, the latter part of August. The Chinese threw up the contract a year ago, as the soil was hard to work, and Japs were taken instead.

Q. Did you ever find out why they threw up the white labor? A. Never heard why.

Q. Could white labor do that work for $15.50 per acre. A. No, indeed.

Q. Were these Japanese working by contract? A. Yes; some twenty had the contract and hired the others.

Q. Who was the head man of the Japanese side of the contract. A. ———.

Q. What was your part over the Japanese? A. ——— was the head; ———, superintendent; ——— was foreman, and I was over the Japanese.

Q. You told them what to do? A. Yes; I told them what was to be done. When they were not doing right I would complain to ———, and he would complain to the boss Japanese.

Q. If they were not suckering right you would tell them? A. Yes.

Q. Suppose one got refractory, what would you do? A. Would have him discharged.

Q. Did you ever discharge any? A. No; I threatened them once or twice.

Q. Where was this boss Japanese? A. He was there and fed them.

Q. What wages did they get? A. I do not know what each man got that was hired by the boss. The work was done for $15.50 per acre. ——— was the boss, and he with twenty others had the contract and whenever they needed Japanese they would get them, and let them go again when not needed, but some were working all the time. ——— kept the boarding-house for the Japanese.

Q. Did you gather that the Japs other than the twenty were in any way chattel of his? A. I could not say; the outsiders could go at any time. If they wanted more men they could go to the city and get them. When I thought it was necessary, I told them they must get more men.

Q. Did you gather that when they wanted more men they got them from the employment agency? A. I could not say; I don't know; I did not think they were contract laborers.

Q. There is a Federal law that prohibits aliens coming into this country remaining under orders from some contractor; as, for instance, you understand what peonage in Mexico means: if a man is here under such contract to work a number of years under a boss who brings him over, he simply reports to his boss. A. I don't think there is anything of that kind.

Q. Did you gather that any of the twenty were owned by the boss? A. No; I don't think they were. I don't think there was any peonage labor there; they would come and go.

Q. There is a great deal of political capital made out of the fact that the contract-labor laws are being violated by the Japanese? A. I think you will find that while there is no proof, the law is being evaded all the time.

Q. You say the Japanese were fed by the boss? A. Yes; he charges them 20 cents per day for board.

Q. What does their food consist of? A. For breakfast: tea, rice, and a few chopped vegetables, with a very little meat mixed in with it. For dinner: tea, rice, and dried baked fish. For supper: same as noon. He will mix one can of salmon with a little cabbage and a little potato for sixty men.

Q. Could a white man live on the same food? A. No; he would starve to death.

Q. Are the Japanese good workers? A. They are, when watched.

Q. Did they employ Japanese to pick the hops? A. Yes; when hop-picking time came they worked the same as the whites, and received the same amount per pound. Some Japanese would make as high as $2 or $2.50 per day, the boss drawing their money. They were then treated the same as the white people. They were paid 80 cents to $1 per 100 pounds.

Q. Could the Japs pick as much as the whites? A. Yes.

Q. Were there any women and girls picking? A. Yes; whole families; men, women, boys, and girls.

Q. How long does the hop-picking season last? A. From three to five weeks. After the hop-picking is all over they start in picking up the string and burning the vines; they take contracts for doing that. They cut the vines 12 to 20 inches from the ground. They save all the old string and sell it; they also take out the wire pins, that fasten the string to the ground, and save them for the next year.

Q. After that do they plow? A. Yes; the white men do the plowing.

Q. What time of year does this hop-picking take place? A. In September.

Q. This land you were clearing was for the sugar-beet? A. Yes. I would not work under ——, so he told me to stay there, and in a few days sent me down to the ——. Worked a month or two steam-plowing; was over a gang of from 40 to 60 in clearing the beet land for the ——.

Q. Where did those Japanese come from? A. Six or seven came from British Columbia; seven or eight from Victoria, and some direct from Japan, no doubt sent to labor here. The boss Japanese went to Marysville, Sacramento, and to this city, and could not get them. Japanese work at Danville and in the hop-fields on the Sacramento River, and so do Chinese.

Q. Who was the boss Japanese in the beet-fields? A. ——; he has a department store and employment office here and in Sacramento.

Q. You say that the Japanese got about 90 cents per day? Do you know what the whites got that used to do the work? A. No; I do not know. I heard Mr. —— say that it was a shame to have taken the work away from the whites.

Q. About how many people were engaged in the picking? A. 1,500 people.

Q. What percentage of them were Japanese? A. About 100 of them were Japanese.

Q. Where the white people come there in that way, do they work as well as if they came separately and had only work in view? A. No; some don't work hard.

Q. How are they paid? A. By the pound.

Q. How much do they average per day? A. About $1.50 per day.

Q. How long does the hop-picking time last? A. Four or five weeks.

Q. It is evident that a large proportion of the money paid for picking goes into the hands of white labor. The next thing is packing? A. Yes; that is done by the whites.

Q. And the drying? A. Altogether by the whites.

Q. How many hands employed in the drying? A. About 100 for weighing, hauling, and drying.

Q. About how many Japanese work from the start up to the picking-time? A. They work about 60 men right along.

Q. And you do not know what they were paid per day? A. No, never knew what they were paid.

Q. Then the drying? A. That was done by about 100 white people and took about four weeks. Then it took about 16 men four or five weeks to press and pack the hops. Then after they were packed they went into the shipper's hands.

Q. Were Japanese used to plant them in the first place? A. Yes.

Q. How long do the plants last? Two or three years? A. Longer than that.

Q. Finally, you find the hops in the brewery and bakery. The Japanese work expends itself on the agricultural work. How did you find the Japanese as workmen? A. Tricky, but worked well if watched; they are very apt and much more intelligent than Chinese.

Q. We were holding an investigation of the industries awhile ago, during which one of the Chinese told us that we were making a mistake in excluding Chinese; that we could not afford to pay high prices, and unless the work in certain industries was done cheaply it would not be done at all, and that certain lines of industries would have been more prosperous if the Chinese had not been excluded. Take this hop-raising: what would be the effect if in place of the Japanese, white labor were employed? Would the effect be to stop the raising of hops to any extent? A. It would increase the price of hops. Where it costs $15.50 per acre now it would cost much more if white labor were employed. In the beet proposition it might make sugar higher if it costs more to raise the beets. To every ton of beets there are 300 pounds of sugar; they pay $12 to $13 a ton for the beets. The —— will plant the beets by white labor and have all the rest of the work done by Japanese. The Portuguese will have to compete with the Japanese.

Q. What would be your remedy for the employment of Japanese? A. Pass an Act against them. I think the Japanese are less harmful to us than the Chinese; the Japanese spend their money here, but the Chinese send theirs to China.

Q. What remedy would you suggest to the orchardist? A. I would do with him just as I would do with every other industry, use white labor or none at all.

Q. That hardly meets the question, as the orchardist will tell you he cannot get sufficient white labor? A. Well, the labor question is going to be very serious; there will be a time from May to November when labor is going to be very scarce.

It seemingly being established that Japanese are here to the number of some 15,000 or 16,000, and the showing being made, as far as evidence obtainable permits, as to how and under what contracts or conditions they come, there follows the important question, "What do they do here?" And to this a general answer may be returned that by far the largest number find employment at common labor. In the large cities and towns of the State a considerable number find employment as house servants, porters, etc. (and as house servants and nurse-maids, a few Japanese girls are employed), but still the total number thus employed is less than generally supposed; no doubt three thousand would include them all. While they appear in many of the trades and skilled avocations, their number as yet in any one is but few. There are some shoemakers and cobblers, some cigarette-makers, some tailors, some light furniture manufacturers, etc., but the aggregate thus employed is perhaps much under the popular estimate, rather than over it; and, as before said, by far the greater number find employment as common laborers at work that can be done simply with the hands. They do not handle machinery, nor drive teams to any extent, but seem more at home delving in the soil; using the shovel or the hoe, or similar hand implements, or the hands themselves; weeding and suckering plants, vines, and vegetables; picking fruit, and the like. As an illustration of the foregoing, and as showing the kind and the percentage of work done by them compared to that done by white labor under the present status, the following intelligent statement given to the Bureau by a gentleman who spoke with knowledge, relative to the employment of Japanese labor in raising hops, is interesting:

STATEMENT OF MR. —— IN REGARD TO THE HOP-RAISING INDUSTRY.

April 23, 1900.

Mr. Meyers: Q. You are of the firm of ———? A. Yes, sir.

Q. Your firm has, I believe, quite an extensive field at ———? A. Yes, sir.

Q. Anywhere else in the State? A. No, sir.

Q. How many acres have you in hops? A. About 260 acres under cultivation.

Q. I believe I am right when I say that hops are rooted in the ground and—— A. The percentage of resets is about ten per cent annually.

Q. Can you give me an idea, Mr. ———, taking an acre of your ground at ———, of about what labor would be required to get those hops in the ground in the first season and get the plant started? Suppose you have the ground cleared and ready for plowing? A. Speaking from memory, though I shall be pleased to prepare a statement if desired, I estimate two plowings and one cultivation required at a maximum of $3 per acre; measuring the acre and checking it off so as to give, say, about eight hills to the acre, digging the holes and planting the roots, will cost in the neighborhood of $10 per acre. The value of the roots planted will be about $6 per acre. The cultivations after planting depend upon the amount of weed growth, varying from two to six cultivations, and costing approximately 50 cents per acre for each cultivation.

Q. The work of how many men would be required, and for what period of time, to do that work? What amount of labor does an acre of hops give employment to? What proportion of that labor is done by aliens, and what proportion is done by other classes? A. I would say: The initial labor of plowing and planting is done exclusively by Caucasian labor; the cutting of the strings and the splicing is done by the children

of the neighborhood; the labor of tending the roots and the stringing is done, in sixty or seventy of the yards, by Japanese and Chinese, and all the labor thereafter is done by white people.

Q. Then, after you get it through the drying process, it goes to the press and then to the teamster, then to the train, and so on? A. Yes, that is it. Two thirds of the cost is labor.

Q. It will then take the labor of one man one day to prepare the ground, or a little less than one man's labor? A. Yes, sir.

Q. Next comes this checking and dividing off, which costs $10 per acre? A. Yes, sir.

Q. Then it takes the labor of how many men? A. Six to seven.

Q. It would take the work of seven to eight men to the acre to prepare for setting the vines. How many men would it take to set the vines in one day? A. About eight. The ground has to be carefully hilled.

Q. Now, then, we have the vines in the ground; now comes this cultivation that costs 50 cents. Is it done with horses? A. Yes, entirely.

Q. A man would cultivate an acre a day? A. It would take more than one man's work.

Q. It would not take two a day? A. No, it would not.

Q. One and a quarter? A. It would take over one.

Q. Cultivation work of one and one quarter men for one day. Now comes the suckering? A. That is a concurrent operation with the first suckering.

Q. Coming to the suckering operation, about what labor goes into the cutting of the strings? A. These children have been paid at the rate of one cent per pound.

Q. After the stringing, suckering the vines, then the tending of them; then comes the labor of picking, then drying, then baling it, then the labor of putting it on the cars or wherever you are sending it to. Do you think this method of attempting to get at a basis to estimate the amount of labor in the hop industry in California is a good one, or can you suggest a better method? A. No; that is a good one. The largest number of yards in California work on this basis.

Q. I want to be in position when I get through to be able to say what percentage of the labor is done by Asiatics? A. You will be surprised to learn that it is the smallest part.

Q. You are going into the beet industry also? Would you be willing to give me the information about the beets also? A. Yes, I would.

In connection with the next foregoing there was also obtained from the same gentleman the following estimate of the cost of raising an acre of hops in California in the year 1899, segregated as to various classes of labor, and as to materials employed.

Cost of Operating One Acre of Hops in California—Season of 1899.
Segregated as to Labor and Material.

	Labor.		Material.
	White.	Japanese.	
Clearing yard		$1 00	
Plowings (2)	$1 50		
Harrowings (2)	1 00		
Cultivations (4)	2 00		
Pruning, Stringing, Training, Arming, Suckering		17 63	$7 58
Harvesting	67 37		13 60
All other	20 21		22 64
	$92 08	$18 63	$43 82

All this is but an example of testimony from various sources tending to the same conclusions, viz: that, as said above, the Japanese are, as

yet, found employed principally in the toilsome hand labor of the field, the vineyard, and the orchard, and that while it is true that they thus displace white labor to a considerable degree, still the percentage of work done by them as compared with the *entire* work performed in any avocation, remains comparatively small.

The employment of Japanese in the sugar-beet industry of the State has been more or less noted and commented upon during the past several years. An effort was made by the Bureau to get a close estimate of the number thus employed, and of the percentage of work done by them, as compared with all the work done in the said industry. To this end a communication was sent to all places where requisite information seemed likely to be obtained, and from replies received the following is compiled; that is to say:

Employed at the Sugar-Beet Factories.

Whites	1,375
Mexicans	10
Total	1,385

Employed in the Sugar-Beet Fields.

Whites	1,500
Chinese	575
Japanese	1,000
Mexicans	850
Total	3,925

The above includes all the sugar-beet localities in the State, and is believed to be a quite close approximation. It shows that the work in the factories is done exclusively by white labor, or almost so; and reduced to percentages it shows again that of the work in the fields done by hired labor, about .14 is by Chinese, .214 by Mexicans, .252 by Japanese, and .38 by whites; while of the entire hired labor in the industry (both factory and field), about .108 is done by Chinese, .161 by Mexicans, .188 by Japanese, and .541 by whites.

An effort was made, again, to obtain an approximation as to the total common labor employed in the fruit and raisin industries of the State, in picking, packing, canning, and drying the respective products. This effort was made through various sources, and as zealously as the means at command would permit; but owing to the area to be covered and the variety of products and processes involved, the task was found difficult, and it is not felt that the estimates given are very close. However, taking as a basis the most reliable data received, the following approximation is made, that is to say:

Whites	120,000
Mexicans	2,500
Chinese	12,000
Japanese	8,000
Indians	1,000
Total	143,500

This, reduced to percentages, again shows that of the labor in the State employed as described in the industries named, .007 are Indians, .017 are Mexicans, .055 are Japanese, .083 are Chinese, and .83 are whites; and it is felt that, so far as percentages are concerned, these given quite closely represent the relative proportion in amount which any one class of the labor named bears to another, or to the whole amount employed as described.

Close investigation was made regarding the unskilled, or common labor, employed upon the various railways within the State, and in so doing a communication was sent to every railway company having track therein, asking information as to such labor in their employ in California. Replies were received in each case, and hence the data on this phase of the subject are very complete, and show that the total number of persons employed upon the railway lines of this State as common laborers, and, respectively, the number of each class or nationality of the same, to be as follows:

Whites	6,570
Mexicans	442
Chinese	393
Japanese	152
Total	7,557

These data were collected during the first three months of the present year (1900), and while, of course, there may have been some change in the interim, such change will not greatly vary the results here shown. Again, reducing to percentages, it appears that of the whole number of the laborers employed as named, .02 are Japanese, .052 are Chinese, .06 are Mexican, and .87 are whites. These figures negative the very general belief that a very great proportion of the common labor employed upon the railways of this State is Asiatic. The labor named includes the unskilled labor employed upon the tracks and in the maintenance of way, that employed about the freight sheds, etc., in the transportation departments, and that employed in the motive-power department around the engine-houses and coal-yards. Of the Mexican, Chinese, and Japanese labor given, the greater part is employed in track work and in maintenance of way, and a very small proportion around the engine-houses and coal-yards.

Summing up from all the foregoing relative to work done by Japanese labor, as well as by all labor other than white labor, in California, it is gratifying to note that although *certain portions* of the work in *some avocations* is largely done by Japanese labor, or by labor other than white labor, the percentage of work thus done, in comparison with *all* the work performed by wage-earners in such avocations, remains very small; and that, taking again all the work performed by wage-earners in the State in comparison with the proportion done by Japanese labor, or labor

other than white labor, the percentage done by other than white labor sinks to a much smaller figure still.

Thus, passing the subject of the coming of the Japanese, and of the kind of work they do, naturally will follow the question: Who employs them? Here again general belief may be somewhat at fault. Of those who find places as house servants, few are found in the homes of what may be termed the "wealthy." Of those performing common labor, the major part are by no means employed by "trusts," corporations, or rich employers. This does not say that *some* are not thus employed, but only that the greater part are not. As porters, etc., they are usually found in the higher classes of saloons. Again, their manufactured wares are not, as a rule, consumed by the wealthy, but by the poorer classes, who must seek economy and cheapness in making their purchases; although the fact must be noted that such wares are often sold in ordinary stores and establishments. Reverting to their employment as house servants; they are most often found thus employed by people of medium wealth, and from that to the class where ability to employ servants ceases. There are also many cases in which the Japanese is young, and is seeking an education, and he takes employment at small wages for but a portion of the day as a house servant, with the privilege of attending school, or in other ways occupying the rest of his time. In the hotels and lodging-houses, from the medium class downward (speaking as to appointment and price), they are often found as porters, and doing chamber work, and in comparatively few instances as cooks and waiters. They are employed to but little extent in the mines of the State thus far. An idea as to the extent of this employment on the railways has already been given. In the sugar-beet industry, as has been seen, they are employed in the fields and not in the factories, and the lands upon which the beets are grown are as a rule in the hands of small holders, who either own or lease them, and simply contract with the factories for the sale of the beets grown; and the Japanese, or other laborers employed in the industry, are hired in gangs by these small landholders; and this holds to a great extent true as regards hop and fruit picking, they being employed in comparatively small orchards and fields, as well as in those under more extensive ownership.

As to the hours of labor per day, they work about the same as does any other class in the same avocation.

As to the wages which they are paid. Those of the student class before referred to, as in housework, receive small pay, \$6 to \$10 a month with board, etc.; and it may be noted, in passing, that this class often displaces, or rather takes the place of, a class of young white girls or boys, say from ten to sixteen years old, who would often otherwise be employed in light work, or caring for small children, or running errands, etc., but who would, however, be paid likewise but small wages for such service. When employed as waiters, or for chamber work, or for general

housework, they are paid as a rule little less than white or Chinese help employed in the same capacity; they, of course, like the others, being paid less while unlearned and inexperienced than when they understand their work. In the trades in which they are employed they as a rule receive somewhat less than white labor, and where they engage in trade or manufacture on their own account their wares are sold by them for less, and their work is done for less than white workers charge for the same wares or work. One singular instance, however, came to my notice, viz: A cigarette factory was started in this State a few years ago with Japanese cigarette-makers; a worker having first been secured from Japan who understood the business, and he having taught other Japanese in turn, until some fifty or more were employed, and were being paid \$1.35 per thousand for making the cigarettes. As time passed a few white girls were employed in cigarette-making at the same factory, and were paid \$1 per thousand, and the pay of the Japanese was reduced to \$1.25 per thousand. Business meanwhile had increased. The Japanese formed a labor union, and demanded an increase in pay and an agreement that white girls would not be employed in competition with them in the making of the cigarettes. They were granted a rate of \$1.35 per thousand for making cigarettes, also their request relative to the competition of white labor. However, white girls continued to be employed; wherefore, dissension arose in the union, resulting, as was represented to me, in the expulsion of the Japanese who remained at work in the factory, for violation of the union rules. A large number of white girls continue to be there employed, receiving, however, but \$1 per thousand for their work, while the Japanese who remain are paid \$1.30 per thousand.

In fruit-picking, etc., the Japanese usually receive not much less than does other labor likewise employed; this work being often paid by the "piece," i. e., so much per given quantity picked. This, however, does not answer the question, "Would white labor be paid more for such work if the competition of Chinese and Japanese labor was eliminated?" It is likely that in many cases it would.

The work in beet and hop fields, as has been seen, is often done by contract with Japanese themselves; and where such is the case the amount they make depends much on the wisdom with which they have bargained; with the qualification that they will take such contracts at a less rate or price than would white labor. Where Japanese are employed by Japanese in such work they are paid, so far as data obtainable speak, in the neighborhood of 80 or 90 cents per day. When employed by white employers by day wages they receive generally about \$1 per day; perhaps a little more or a little less at times, as the case may be; and it will be understood that the ruling wages paid by white employers influence to a great extent the wages paid by Japanese employers. In railway work all common labor employed other than white labor is paid about the same wage, viz: about \$1 per day; white

labor in the same avocation being paid from $1.50 to $1.75 per day; there being no distinction in the hours per day worked as between any class of labor.

As to the worth of Japanese as workers, various testimony has come to hand. To an inquiry addressed to railway managers as to the comparative value of white, Chinese, Japanese, and Mexicans as laborers, a reply was in one case returned which seemed quite deserving of consideration, viz: "That the percentage of the superiority of whites as workers over the other classes named was indicated by the increase in amount paid as wages to whites versus that paid to the other classes." They are generally reported as not as reliable as Chinese, and as more turbulent in disposition. In housework they are spoken of in most cases less favorably than are either Chinese or white workers.

In connection with this general subject the following tables, showing wages paid in Japan as late as 1897, and in Mexico at the present time, in various avocations, may be of some use. The tables are far from complete, but they are as nearly so as has been possible to make them. Data as to wages in most of these countries are very meager. Persistent effort has been made, but without success, to secure figures from some authoritative source as to present wages paid in China. Among the Japanese themselves persistent claim is made that wages in Japan have greatly increased within the several years next prior to this time, but nothing has been secured relating thereto sufficiently definite to justify publication.

Wages in the City of Mexico, 1900.

Occupations.	Hours per Day.	Wages per Day.
Bakers	5	$0 32
Blacksmiths	10	1 62
Boilermakers	10	1 81
Bricklayers	10	85
Cabinetmakers	10	1 25
Carpenters	10	75
Coopers	10	1 00
Conductors, railroad	--------	2 75
Domestics	--------	31
Engineers, railroad	--------	3 75
Engineers, stationary	10	1 25
Harnessmakers	10	81
Laborers, common	10	31
Laborers, agricultural	11	34
Machinists	10	1 37
Miners, quartz	10	68
Miners, iron	7	68
Molders	10	1 17
Painters	10	68
Pattermakers	10	1 50
Plasterers	10	62
Plumbers	10	1 87
Printers	10	87
Quarrymen	10	1 00
Shoemakers	--------	87
Stonecutters	10	1 25
Upholsterers	10	56

Mexican currency reduced to its equivalent in United States money.

Wages in Japan, 1897.

Occupations.	Wages.	
	Day.	Month.
Blacksmiths	$0 24	
Brickmakers	28	
Carpenters	24½	
Compositors	18	
Confectioners		$4 82½
Coopers	19	
Door and screen makers	23	
Dyers	17½	
Fishermen	19½	
Gardeners	23½	
Jewelers	21	
Joiners	22½	
Laborers	17	
Laborers, agricultural (male)	15	
Laborers, agricultural (female)	09½	
Lacquered object makers	22½	
Metal utensil makers	24	
Mine-workers	24	
Oil-pressers	18½	
Papermakers	17½	
Pasters, paper	22½	
Plasterers	25	
Printers	17½	
Roofers, shingle and thatch	24	
Roofers, tile	27	
Saddlers	23	
Sake-makers		4 95
Sawyers	25	
Scutchers of cotton	17½	
Servants, domestics		1 41
Servants		79½
Ship-carpenters	25	
Shoemakers	23	
Shoemakers, Japanese shoes	19	
Silkworm cultivators (male)	16½	
Silkworm cultivators (female)	10½	
Snuff box, purses, etc., makers of	20½	
Soy-makers		4 18½
Spinners, silk	11½	
Stonecutters	27½	
Straw-matting weavers	22	
Tailors, European clothing	29	
Tailors, Japanese clothing	18½	
Tea-preparers	22½	
Tobacco-cutters	21	
Weavers (male)	13½	
Weavers (female)	09½	
Wheelwrights	20½	

One very noticeable feature of the presence of Japanese among us is the zeal which they display in becoming Americanized in manners and customs, and in this they differ greatly from the Chinese. The latter never forget their native land; at least, to any outward seeming. As far as possible they retain their Chinese costume, and go their Chinese ways as completely as though they were in Canton. The Japanese, on the other hand, seemingly devotes his first earnings here to acquiring American surroundings and habiliments; he buys American food and beverage (including at times our wines and liquors); his wife and children, likewise, if he have them, are dressed in strict accordance with

our style; and in this way a large part of the earnings come back to us. Of course his patronage is, where possible, in most part bestowed upon his own countrymen who deal in our commodities, but this is not exclusively so, and altogether we can but little complain of him as regards the disposition of his wages after they are earned.

It has been said in another part of this report that on the prosperity of its wage-earners must rest the ultimate general prosperity of a nation, and that any agency, be it whatsoever it may, which in its tendency forces the price of labor in any avocation below the point at which it might otherwise be fairly maintained, without in its effect stifling enterprise in such industry, menaces the general good; and immigration of any kind which thus tends to lower the wage of the California worker should be discouraged by all legitimate means. In another part of this report will be found tables giving the wages paid in various avocations in California, as compared with other States and countries, and by them will be made plain the fact that the condition of the wage-earner of California as regards pay and hours of labor is good as compared with the condition of the wage-earner of other places, and we wish it to remain so.

FEMALE LABOR IN THE STATE OF CALIFORNIA.

Evils are easily found; remedies therefor are in most cases found only with great difficulty.

Female labor and its condition in this State present a wide and interesting field for investigation; and no doubt in many cases improvement in conditions could be made if proper remedies and feasible methods of applying them were at hand. Like many others in the industrial world, the subject is intricate, and he who would investigate with view to improvement finds his way beset with difficulties and disappointments not plain to casual view. He or she who begins with the morning upon a seemingly simple task of reformation, and promises that before the evening the work will be done, often before high noon discovers that what in the beginning seemed the evil was but its incident, and that the evil itself or its cause is so intricately interwoven with other evils and with other interests, and that the agencies from which it grows and which sustain it are so many and so varied, that the work of ultimate correction is one of ages, and includes, perhaps, the remodeling of human nature itself.

Unfortunately, limited means and shortness of time have together restricted investigation and action regarding this subject to a considerable extent, and hence progress is much short of what it is hoped it will be within the next several years; from which it follows that this presentation must be far from perfect or complete.

It must not be supposed that this is preliminary to assertion that the condition of female wage-earners in California is, in comparison with other States and countries, deplorable. Such is by no means the fact. On the contrary, its comparative condition is, as a rule, good; but that makes not reason why it should not be made better where possible, and it is believed that in many cases improvement not only might be made, but should be made.

The avocations in the State in which women find employment are in great variety. But in beginning we may note that in field work women are seldom employed; and in this respect we differ here from most of the countries of the Old World, from many of the countries of the Western Hemisphere, and even, perhaps in lesser degree, from some of the other States of our own Union. Light outdoor work, such as hop-picking, small-fruit picking, etc., is done by women and children to some extent at times, but scarcely in sufficient amount to be important as an industrial factor. Dairy work is performed by women in some degree, but even here the modern dairy appliances and inventions are revolutionizing the industry, and the old processes of butter-making and butter-working are giving place to the new, and in the new, woman has a lesser part. The work of woman on the farm has likewise in many cases undergone much change. Harvest and seeding time are perhaps no longer in such degree her days of trouble. The harvesting outfit complete, including its modern cook-house and all the rest, with the harvest comes and goes and leaves her undisturbed. Work still to do she has, but it is believed in less laborious degree, and that such change in methods as there has been is for betterment in her condition.

But, displaced in some degree from the employment of the dairy and the farm, there suggests itself the question: "What has woman found to do in lieu thereof?" To which reply is made: "Other avocations"; of all of which in turn.

House work in its several varieties continues to give employment to large numbers of women and girls; for while, as known and shown, other classes of labor have come in later years to be employed in this avocation to a considerable degree, the larger portion, when we take the entire number of wage-earners engaged therein, remains the work of women.

In the field of educational work woman well maintains her place, and in fact, as spheres of learning have enlarged, the field for her therein has broadened.

In stores and mercantile establishments the employment of women has much increased, both at the counters as clerks, and in the offices as bookkeepers, secretaries, and stenographers.

And also in business offices of all kinds—professional, mercantile, manufacturing, transportation, governmental, municipal, and all—wherever writing is done or correspondence carried on, woman is found with stenographer's pencil and typewriting machine; and in fewer cases, perhaps, as confidential clerk or secretary.

In the professions they do not, as yet, much intrude. In the law they are so few as to be isolated when there at all. In medicine they are much more numerous, and still not many comparatively. Professional nursing has its numbers. In medical laboratories there are some engaged.

Journalism attracts a few. (Perhaps I should say many, and that few remain.)

Theaters attract a few.

As agents and canvassers, some are employed.

In some of the processes of photography their work finds place.

In various of the trades women are employed in numbers more or less. Thus, in printing, as proofreaders, typesetters, etc.; although the introduction of the linotype machine has in this avocation made their numbers, as well as those of the men workers, very much less. They are also employed in more or less degree in some of the processes of cigarmaking. Some women (or rather girls, as a rule) work in foundries, although this may seem peculiar to many, their employment there being to clean and brush light castings, etc.

In some of the trades they are numerous; such as in dressmaking, tailoring, millinery, etc.

In various manufactures women are employed; such as garment-making, glove-making, etc.

Modern inventions have opened vast avenues of employment to some of the women. Thus they are employed in telegraph offices, and in great numbers as telephone operators.

The various branches of the increased and increasing fruit industry of the State give to women, during a considerable portion of the year, a great amount of work, and this industry, too, has in turn incidentally created still other fields of employment for women, such for instance as the making of cans, labels, and other articles used in carrying on the industry.

The steam and French laundries furnish work to several thousand or more.

The foregoing includes the principal avocations within the State which give employment to women, though it includes by no means all.

The principal evils to which women wage-earners may be subject

in connection with their employment (and the same is true of men wage-earners as well) may be brought together under four general heads, as:

(1) Uncomfortable or unhealthful conditions and surroundings in places of employment.

(2) Harsh and unjust treatment in connection with employment and in connection with wages earned.

(3) Low wages.

(4) Excessive number of hours required per day's work.

Fortunately, as regards the first named, the legislative police power can do much toward providing remedies; and that power in this State has already gone a considerable way in that direction, although in some things there may be apparent room for improvement, and in others improvement might be made if facts were more fully known. Under this heading the chief difficulty is not in providing remedies, but in applying them. Efforts in that direction find many obstacles. Employers are often slow to perceive that improvement could and should be made upon their own premises, while in no way loth to proclaim that improvement should be made upon the premises of others. Women and girls are, as a rule, extremely fearful in the matter of complaint (perhaps in many cases justly so), on the ground that discovery of the fact that they had complained would mean for them loss of place; and in this connection we may say that almost all of the complaints received by the Bureau in this regard are anonymous, or are made under the seal of secrecy. It is simply impossible for the Bureau, with the force and means at its command, to so police the State as to promptly discover the existence of evil conditions such as referred to, and dependence must be placed upon information voluntarily given; and, as has been said before in many places, and here repeated, I invite information from all who have, or who believe that they have, knowledge of things under this heading which should properly have the attention of this Bureau. There is a law of the State which says: "No basement, cellar, underground apartment, or other place which the Commissioner of the Bureau of Labor Statistics shall condemn as unhealthy and unsuitable, shall be used as a workshop, factory, or place of business in which any person or persons shall be employed." The particular attention of both employers and wage-earners is hereby called to this law; and in connection with it, the condition during cold weather of many workrooms in which women are employed might be improved without doubt if cases were brought to light. Some I have known where girls would come at early morning, to work in rooms in which the atmosphere was chilled far below the point of comfort, and there, with no provision made for warmth, must sit or stand at their work in shivering endurance, perhaps for hours.

Another provision made by the law of the State is for the seating of

female employés in all establishments where the same is possible. This, however, is quite generally observed; the matter having had some considerable attention in the last year or two.

One surprising thing, however, in regard to some of these provisions for the health and comfort of employés is the lack of knowledge, often professed, or confessed, on the part of employers, as to their existence; it being common to be told, and oftentimes with undoubted sincerity, that they had been unheard of there before; certainly, it seems singular that things so important to the employers of labor should be so often unknown to such employers.

Employers, too, are resentful toward attempts to investigate or to suggest regarding conditions in their establishments, and in occasional cases place obstacles, either openly or covertly, in the way of endeavors to obtain correct information.

In connection with complaints regarding evil conditions under this head there must be great care exercised in taking action. The law is meant to be just and impartial, and it must be justly and fairly administered, having in view the rights of the employer as well as the rights of those employed. The law is intended to improve where justly possible; it is not intended to oppress or harass. It is common for ex parte statements and complaints of evil conditions to be made and repeated, sometimes in distorted form, and hence every complaint must have investigation, and a fair chance for hearing of all interests concerned, before even opinion as to its merits is formed; and all these manifold things combine to make true the prior assertion, that under this head it is not the lack of remedy which perplexes, but the difficulties which beset the application of the remedy.

Under the second heading we find much difficulty, not alone as to the application of remedies, but as to the remedies themselves. It is difficult by law to correct infirmities of disposition, and yet in these infirmities originate most of the complaints that come under this phase of the present subject. Displays of temper on one side or the other often end in discharge or resignation from place, and such things before experienced often turn women away from search of employment in some particular direction, which search would otherwise be pursued. From employment in housework quite frequently comes the complaint of things of this nature. Nor is the fault by any means found at all times to be on the side of the employer. Complaint comes from that side, too, of insubordination and lack of consideration for the interests of employers; of waiting guests, and, coincident therewith, the cook's resignation without warning. For all this there seems no remedy at present and for the future only the hope that it will bring us toward the millennium when human infirmities will disappear.

A further evil under this heading is the loss of wages often occurring to the worker. The sums usually are so small as to forbid an effort to

collect them by legal process; and that fact is apparently often taken into consideration by the debtor in his refusal to pay. Sums of from one to twenty-five or thirty dollars are in this way frequently lost by wage-earners, as will be shown in another part of this report, where mention is made of particular complaints of this nature. As stated, the sums are so small as in most cases to be less than an attorney's charge would be for prosecuting them, but they are, nevertheless, in many cases, large to the person who has given honest toil in earning them. Here again remedies are hard to find. One which would do great good, if practicable, has been recommended by some of my predecessors, and is, in substance, that the State retain an attorney in connection with this Bureau to prosecute all such wage claims, free of charge to the claimant. This, as said, would do much good, if practicable. A difficulty in connection with its operation would be that such an attorney would be able to cover but a limited territory, while the evil is State wide. Again, it may be doubted if such a law would stand judicial test as to being "class" legislation. The question is, however, one which well deserves consideration at the hands of this Bureau and of legislators, and it is hoped that time may make plain some remedy which will abate the evil. As it is, the Bureau can only do the best it can in those complaints which, after investigation, the complainant appears to have been wronged.

The third heading, "low wages," speaks of a source of complaint for which little direct legislative remedy can be found. To many it would seemingly be an easy matter to pass a law saying that in no avocation should the minimum wage be less than (for example) two dollars a day; and yet all such laws fail before a judicial test, as being infringements upon the civil right of persons to make such contracts as to them seem proper, as regards the price to be paid for what one may wish to buy and the other may wish to sell. There seems, to some, to be a departure from this in a State or Federal law which prescribes the minimum which shall be paid by an official for work done for the State or Federal government; but there is, in fact, no departure; for as the private employer may prescribe the wage which he will pay for work done for him, so may the Government, as an employer, prescribe the wage which shall be paid in its behalf to the worker in its employ.

The law and the Constitution stand in the way of legislative remedy in this regard, and again it may appear that the vote of the people might in time by constitutional amendment wear the obstacle away; and yet, if this be true, the question comes, "Would it be wise?"

The legislative voice that then might say with authority, "You may not be required or permitted to sell your labor for *less*," might with equal authority say, "You are not permitted to sell it for *more*." This has not been unheard of in the history of the world. We need turn but few years back upon the path of progress of human liberty and human

enlightenment to find the time when the law did not permit the worker to put his own price upon his toil when that price was above the maximum which the law allowed. From all this it will be plain that little remedy for the low-wage evil can come from legislation directly fixing a price for labor. Indirectly, however, legislation by encouraging the industries of the State or of the Nation, and by encouraging enterprise and the investment of capital, can do much toward upholding the wages of labor. It can help to create conditions which will cause the demand for labor to increase, and of which labor itself can then take advantage; and after which labor's best remedy for low-wage evils will be found to be within its own hands through the medium of intelligent organization, where that is possible; but then all kinds of labor cannot effectually organize, and the public opinion of the State and of the Nation should at all times set aggressively in favor of the proposition that the most prosperity for all classes is found when the worker is everywhere, in all avocations, being paid the highest wage that can be paid consistent with a healthful condition of the industry in which he is engaged.

Tirades against employers individually in this regard do little good as remedies. In the keen competition of commercial life, and for custom, he who under even conditions would pay more than his competitor, would ofttimes simply but sacrifice himself. The buyer too often seeks for cheapness, without regard for the manner in which cheapness may come; but when the great public, whose heart so generously and readily throbs in sympathy for the poor overworked and underpaid woman whose toil helps to create the things it buys, shall learn to know and to remember that all cheap things speak but of labor cheaply paid, and shall demand of those with whom it deals not only cheapness, but that labor's fair recompense shall come first sometimes and cheapness after, then will come a time when the tirade against the individual employer who treats his workers ill will be of force, and he who treats his workers well will be not self-sacrificed.

As to wages paid to women in the several avocations, it may be, in general, said: That in housework they receive from $15 to $25 a month as a rule; in a few cases $30; and in many cases young girls who care for children and do light work are paid but $2 to $3 per week.

As clerks in stores and similar places, they ordinarily are paid from $5 to $8 per week; apprentices and beginners, $3 or $4 per week when first placed on the payroll. Saleswomen of large experience of course receive more in large establishments and important places, and in such cases $15 a week may be paid, but such cases are more the exception than the rule, and the purpose here is to give what ordinarily is paid.

As bookkeepers, stenographers, and secretaries, their wages vary greatly. Beginners receive often as low as $5 to $7 per week, the wages varying from that, with experience, position, and establishment to $100 per month; $40 to $65 per month being common.

In trained nursing, $2 to $5 per day is paid, but the work is irregular, and is in fact more professional than otherwise, and hence a standard is hard to approximate.

In journalism their pay is usually by space, and depends entirely on capability and energy. Twenty dollars per week would perhaps be a fair estimate of averages.

In theaters there is likewise scarcely any standard, and the same is true of those employed as agents and canvassers, who are generally paid by commissions, their income depending again upon ability and energy.

In ordinary photographic work their pay is small; say from $5 to $8 per week.

In printing, linotypers are paid by the piece as a rule, and can earn from $18 to $30 per week. Proofreaders receive about the same; and in positions of less degree from $5 to $7 a week are paid.

In dressmaking, tailoring, and millinery, beginners usually receive from $3 to $4 per week, and after attaining average experience and capability are paid from $6 to $9 per week. After that a higher wage depends upon exceptional capacity, position, or establishment.

It was before noted that in some cases girls worked in tinware-making establishments. Their work there is usually to tend cutting and stamping machines, and they make from $5 to $8 per week.

It was also noted that they worked at times in foundries at cleaning small castings, etc. At such employment they are paid some $4 or $5 per week.

As telegraph operators they average about $45 per month; some being paid as high as $60 per month, but those cases are exceptional.

Telephone operators begin at about $3 per week, and after attaining average experience and capability receive about $25 to $30 per month, with overtime of about 12½ cents per hour if required to work more than regular daily hours.

In the laundries the girls begin at about $4 per week, and with experience and capability rise to $25 to $35 per month; but in this employment they are often paid by piece work, and in such cases their earnings are measured by capability and energy, $45 and $50 per month being in some cases made.

In the canning factories, and in the drying and packing houses of the fruit industry, girls and women receive, when paid by time, from $5 to $10 per week; but by far the larger part of their work in these places is paid by the piece, and once more their earnings vary with skill and energy; a dollar a day being readily made by an average worker, and from that to a dollar and a half being not uncommon.

The foregoing resumé of wages paid should not discourage the idea before advanced that in many cases improvement in the way of increase not only might, but should be made.

Coming now to the fourth heading, viz: "excessive number of hours required per day's work." In a number of the avocations enumerated this evil exists, and the remedy therefor is not easy to find nor to apply. In housework and in housework avocations where women are employed, their hours of daily employment are as a rule many, ranging oftentimes from five or six o'clock in the morning until eight or nine o'clock at night. In many mercantile establishments, too, the hours are excessive as to number per day's work; and open eyes can but see, especially in candy and ice-cream establishments, where in the cities ladies and their escorts often go after the theater is over, girls who have been at work since perhaps eight o'clock in the morning, still waiting on customers at half-past eleven o'clock at night; and this would seem a case wherein the force of sympathetic public opinion might work a change. Candor forces admission that the seemingly prevalent idea, that the lot of the worker in large establishments is always deplorable in comparison with the condition of those in smaller places, as to pay and hours of labor, by no means holds as the rule. On the contrary, in the majority of cases the large establishment, conducted more by system, and forced by necessity, arising from the fact that where many are employed their influence upon their own condition is greater than where there are but few, requires of its employés fewer hours of labor than does the small establishment. In the cities it is the rule for the larger mercantile places to close early in the evening, while the smaller ones close late. In the large garment-making places, where numbers are employed, ten hours' work per day is the rule, while in small ones there is scarcely any rule or limit; and this holds good through most of the avocations. This does not say that the hours per day are not in many cases too long in the larger places, but that as a rule they are better there than in the smaller ones.

In office work the number of hours per day required of women workers is as a rule reasonable; about eight hours per day being the usual time, with an interval for lunch.

In most of the trades they work about ten hours per day, which is surely long enough.

It has remained for the women workers in laundries to be one of the most overworked classes of any as regards number of hours worked per day; it being not uncommon for them in certain seasons of the year to stand at the mangles and at the ironing tables from seven o'clock in the morning, almost continuously until eight or nine o'clock at night. This evil was one of the first called to my attention when I assumed the office of Commissioner of the Bureau, and I gave it much consideration. It was at once apparent that any remedy applied must be such as would treat all alike within a given place or environment. An employer could not, even if willing to do so, and do justice to himself or to his

employés, require fewer hours of work per day in his establishment than his competitors are requiring in theirs, unless the public with its patronage properly supports him in so doing, since he would simply place himself at a disadvantage in the matter of price and convenience to his patrons as compared with his said competitors, with the result that in time his business would be destroyed and his employés would lose their situations, while the less humane employers would continue to prosper and their employés to be overworked.

Direct legislative remedy for excessive hours of labor is not easy to obtain, since there stands again in the way the obstacle spoken of in connection with the legislative regulation of the wages of labor, viz: conflict with the right of persons to contract as they may choose, regarding the disposition which may be made of what one may have to sell and the other may wish to buy. Here again the best method of regulation is the organization of labor, and intelligent methods on the part of such organized labor in furthering and protecting its interests. But here again some classes of labor cannot be effectively forceful in the way desired even by organization, and they are the ones who should, wherever possible, have legislative protection; and who are more deserving in this regard than the women wage-earners of our State who strive, by honorable toil, hard though its conditions often are, to support themselves and those dependent on them? It answers not to say that if conditions are onerous, the women are free to refuse to work. As has been recognized in able language by the Supreme Court of the United States, the necessities of the worker place him under duress in many cases, and he stands then not upon an equality with the employer in contracting for the price and condition of his labor.

Regarding excessive hours per day of women wage-earners in laundries, and complaints thereof at the time I assumed the office of Commissioner of the Bureau, which complaints came principally from the City of San Francisco. I found in several laundries that it was the rule to work not only late at night, but on Sundays as well. I found this Sunday work to be contrary to a provision of Ordinance No. 1930 of the City and County of San Francisco; I therefore, after due warning to such several laundries to discontinue such Sunday work, caused the arrest of the proprietor of one of them, who persisted in working on Sunday, upon a charge of violating the provision named in Ordinance No. 1930. Conviction was had in the Police Court, but a writ of habeas corpus was taken by the defendant to the Superior Court, where Judge Lawler, after hearing, and after having the matter under advisement for a long time, held the provision in question to be invalid.

Some time later complaint chanced to be made that, located as they are in all parts of San Francisco, the noise and tumult occasioned by the operation of laundries there during late hours of the night caused disturbance to public repose, while the danger from fire, arising from

the same cause, menaced public safety. Investigating this complaint I found that another provision of the said Ordinance No. 1930 prohibited washing and ironing clothes in the public laundries of San Francisco between ten o'clock P. M. and six o'clock A. M., and that this provision had been upheld by the Supreme Court of the United States, on the very ground that it was a proper legislative exercise of the police power of the State to protect from the very disturbance and menaced danger named, and that it was also held that the time during which such protection should in any case be extended was largely within the discretion of the legislative power; and it occurred to me that the disturbance and menaced danger named began in fact in San Francisco at a much earlier hour than ten o'clock P. M. I therefore addressed a petition to the Board of Supervisors of the City and County of San Francisco, praying that they amend the provision in question of Ordinance No. 1930, and cause it to prohibit the laundry work in question between the hours of seven o'clock P. M. and six o'clock A. M., instead of as it then provided. The public press, the labor organizations, the public itself, and the Board of Supervisors, in all cases heartily supported the petition, with result that the amendment named was made. An incidental result of this amendment has been the lessening of the number of hours per day which wage-earners may be required to work in laundries in the City of San Francisco; since, whereas, theretofore they might be, and often were required to work from seven o'clock A. M. until eight, nine, or even ten o'clock P. M., thereafter they could not be required or permitted to work after seven o'clock at night.

The question whether there can be direct legislative protection extended in many cases to women wage-earners in this State, as regards the number of hours of their employment per day, has had my earnest consideration for some time. In the case of minors there is little difficulty; since, proceeding upon the theory that, owing to immature capacity, the minor is unable properly to protect his or her interests, the legislative authority is ever willing, when invoked, to give protection, and its action in so doing, upon the same theory as said above, is uniformly sustained by the courts. But when the worker crosses the line which divides minority from majority, she is left thereafter to her own resources. In a few of the States legislation limiting the number of hours per day during which women may be required to work in given avocations has been enacted; its usual basis being the theory that, for the public good, the physical welfare of woman should be safeguarded; but such legislation has been uncertainly received by the courts as a rule, and seemingly seldom upheld unless authorized by special constitutional mandate of the State in which enacted. Thus, the Legislature of the State of Illinois enacted a law providing, in substance, that in many avocations women should not be required or permitted to work more than eight hours in a calendar day. This law was declared unconstitutional, as being an

invalid restriction of civil liberty. In Massachusetts a law was passed, similar in all respects save that the maximum number of hours per day during which it permitted women to work was ten instead of eight. This law was upheld by the Supreme Court of Massachusetts. But there is a distinction between Illinois and Massachusetts in this regard, which is that Massachusetts has in her Constitution a provision to the effect that her Legislature shall, by the enactment of proper laws, provide for the health and welfare of women employed in the respective avocations, and it was under the authority of this constitutional provision that the Legislature of Massachusetts acted. Illinois has no such constitutional provision.

Under similar conditions a law of the State of Colorado, providing that no one should be required or permitted to work in mines more than eight hours in a calendar day, was held invalid by the Supreme Court of Colorado; while a similar law of the State of Utah was upheld by the Supreme Court of that State, and in turn by the Supreme Court of the United States. In both cases the law was based upon the theory that continuous underground work in mines was peculiarly unhealthful to those engaged in it. But the Constitution of Utah provides that its Legislature shall, by proper legislative action, provide for the health and welfare of workers in the mines, while the Constitution of Colorado contains no such mandate.

In most cases the courts of this State have held as invalid legislation which seeks to regulate the number of hours per day during which employés may work, or during which business may be carried on, in any avocation. Thus, laws regulating the hours of bakers and of barbers have been held invalid. Whether laws regulating the hours of labor of women, and based upon the theory, as above stated, that public good requires that the physical welfare of women should be safeguarded, would have the sanction of our courts, is a question as yet unanswered, with probabilities perhaps in favor of the negative; but in view of all the foregoing, a suggestion is made, which it is hoped will have the serious consideration of the people and of the legislators of the State, and it is, namely, that an amendment be made to the Constitution of California, providing, as is done by the Constitution of Massachusetts regarding that State, that our Legislature shall, by appropriate legislation, provide for the health and welfare of women wage-earners in this State, and, with our Constitution thus amended, it would seem that we should be able, by direct legislation, to provide sure remedies for evils that now obtain in many cases under this "fourth heading."

As was said in the beginning, the subject here is intricate and the question beset with difficulties, and this presentation of it is far from perfect or complete, but it is hoped that the next several years will show greater progress made.

LABOR-SAVING APPLIANCES AND PROCESSES,

And the Effect of Their Use, as Regards Displacement of Hand Labor in California.

This subject presents a most interesting field for study. Investigation regarding it leads into all the industrial and economic questions of the age. It invites comparison of the condition of the wage-earners of the various nations of the earth. It deals not alone with the direct effect produced upon the workers of a single avocation by the introduction of a labor-saving appliance into such avocation, but it deals as well with the ultimate effect upon the workers of the whole industrial world, which results from the direct effect of such labor-saving appliance introduced, as said, into a single avocation. In its broad scope the subject includes, too, not only the effect of such appliance as to mere displacement of labor, or vice versa, but also the effect of the use of such appliance upon the enlightenment, civilization, comfort, and well-being of the whole human family, including therein the wage-earner himself.

As to California, it may be said that people nowhere are more progressive in keeping step with modern improvement than are the people of this State. The vastness of the industries in which California particularly leads encourages greatly the use of machinery, and the large and Western spirit of the people urges progress and up-to-date methods in the doing of all things. While in many of the countries of the Old World, and perhaps in some of the New, the laborer yet bends toilsomely with the sickle to gather the harvest, and finds an acre to be the work of days, in California several workers, with a mechanical monster, whose motive force perchance is fire and steam, drive through a hundred acres between the rising and the setting of the sun, and the standing grain of to-day is made the flour of to-morrow, which is placed on shipboard, destined to feed the distant peoples of the earth. In the fruit industries of the State it is in principle the same. In mechanical shops and manufacturing places, in mercantile establishments, upon the lines of transportation and of communication to and fro, everywhere, mechanical fingers are doing more and more the work of human hands, and mechanical appliances are taking the place of human intelligence; and to superficial thought this may well suggest belief that labor is being forced from places of employment into idleness and resulting distress.

Beyond doubt, the impression is quite general that mechanical appliances, as they increase in numbers, increase the number of the unemployed. At least one false premise usually accompanies this belief, and that is the assumption that in a given avocation the same amount of work would be done if mechanical appliances were discarded

as is done with such appliances in use; that hence, without such appliances more workers would be employed; that a greater demand for labor would result, which would in turn make higher wages the rule. But with reflection reason forces recognition of the fallacy of the assumption. Without the telephone, would as many communications pass as now do with it? Without steam engines, would the volume of traffic and commerce ebb and flow in quantity the same? Without ability to quickly and cheaply transport, would manufacturing, agricultural, and other industries be as extensively carried on? Without the loom, would fabrics still be woven as now with it, and without ability thus to weave would raw materials still be in demand the same? Some may answer that man must live, and must be fed and sheltered and clothed; that the work thereby occasioned must be done some way, and that human hands would do it if mechanical appliances did not. All of which is true, with this premise: that with but the work of human hands, man would live less well—would have less shelter, less food, less raiment.

The close sympathy and interdependence between the several avocations are plainly manifest. What makes possible increased activity and prosperity in one, conveys like activity and prosperity to another, and thus in turn to a third, and so on, and on again, ad infinitum; and it can be believed without great effort that an appliance introduced into, and making cheaper the conduct of, an industrial enterprise, even if in so doing it displaces labor in that enterprise, has, by the time the circle is complete, and ultimate results are balanced, left labor as much or more employed than it was before. With the advent into the harvest of the mechanical monster before named, an army of workers laid down their sickles and departed. When the marine engine came upon the ocean, unnumbered sailors ceased to "lay aloft." When the locomotive claimed its place in the commerce of the land, the driver of the stage coach and the teamster of the wagon train passed out of sight. With the coming of the telephone the usefulness of the messenger boy was almost wholly at an end; and with the introduction of the systems of intricate wires into mercantile establishments, the call for "cash" was silenced. All thus displaced may, to superficial thought, have gone to join the sorrowful and suffering army of the unemployed; but have they in fact done so? The very appliance which displaced them has created new avocations, and new opportunities for employment. They have gone to the forest, and the sound of the ax is heard. They have gone to the mine, and from its depths they dig out the metal and the coal. They meet again in the foundries and the mills to shape and fashion the very instruments that in the beginning seemed to be their own undoing. From the high to'gallant yard they have gone to the hold of the mighty ship, and to new avocations amid pulsing demons of steel and steam. They are girding the continents with steel, they are harnessing the elements of nature, their occupation is without end.

In another part of this report appears a table which shows comparison as to the hours of labor per day, and wages per day, of workers in various avocations in several of the States of the United States, and in several of the countries of the world, and therein a fact is made apparent, viz: that the United States and England lead the nations of the earth as to the well-being of wage-workers, and that Japan, Austro-Hungary, and Mexico appear at the other end of the procession; and in this connection note the significant fact that in the use of machinery the United States and England lead the world again, while Japan, China, Austro-Hungary. Mexico, and similar others follow once more at the last of the line, Wherever modern mechanical appliances remain unknown, labor is found still ever close to the ground, still ever poorly paid, still ever more in idleness, in poverty, and in rags.

There is a rule in mechanics, in substance, viz: "That what is gained in power is lost in time," and vice versa.

Assuming that a man possesses one hundred units of power, and that it takes such one hundred units to lift a given weight one foot in one second, the man can by direct effort barely lift the weight the distance named in the time prescribed. By the use of a lever or a pulley he can lift the weight the same distance with a less number of units of power but he must take more time in which to do it. The question as to how far the *principle* of this rule applies in the use of what is termed labor-saving machinery is interesting. A certain number of units of hand labor, directly applied, are required to harvest an acre of grain. With the modern "harvester" the number of directly applied units of hand labor to do the same work is infinitely less, and yet when we take into account all the labor that has gone into gathering and fashioning the materials of which the implement is made, the putting together of those materials, and the maintenance of the machine in operation, including the furnishing of the motive power therefor, surely the question of how much labor has ultimately been actually saved in the sum total of industry is interesting; and when we add to this the question of how much the opportunity for employment of labor has been increased by the increase in agricultural products made possible by the use of the machine in question, there is suggested, to say the least, the conclusion that the term "labor-saving" appliance is a misnomer, and that the term "labor-diversifying" appliance would be more expressive of the truth.

This question of *ultimate* result does not appeal with force to the understanding of the man who has lost his job through the invention of a machine which does the work he used to do. The printer, deprived of place when the linotype came to his desk, and forthwith, with treble speed, did the work which he had spent years in learning to do, and who hence stands, at middle or old age, perhaps with life trade or occupation gone, feels forcefully the fact that he is idle, and finds but

doubtful encouragement in the thought that he may find work and livelihood in avocations new and to him strange; and yet, looking to labor as a whole, to final results when balances are struck, it scarce can be that labor is found less employed because machinery is so much used; rather, there seems forced upon us the conclusion that the so-termed "labor-saving" appliances are instead creators of employment for the workers, and that with such appliances unknown industrial enterprise everywhere would stagnate and die, while labor here would find the level of labor in the countries where all work is yet done by human hands alone.

And once more as to the effect of the so-called "labor-saving" machine upon the comfort and well-being of the human family. There is no measure for its extent. In the necessities, the comforts, and the refinements of life its influence is everywhere; without it what would mankind in this age do? The question presents an interesting field for study. It is addressed to the many among the workers of the nation who see in the multiplying mechanical appliances in use in the industries of the world the final end of all prosperity to labor. Perhaps they are right, but both fact and reason seemingly say no.

PRINCIPAL AGRICULTURAL, VITICULTURAL, ETC., PRODUCTS OF CALIFORNIA.

The report of this Bureau for the years 1885–6, published by Hon. J. S. Enos, the then Commissioner, contains an interesting chapter relative to the topography and the products of the various counties of the State. During the early part of the present year I addressed a communication to the Assessor of each county in California, of which said communication the following is a copy:

San Francisco, Cal., April 9, 1900.

Mr. ——, Assessor, —— County, Cal.:

Dear Sir: Have you data (or, if not, can you secure it) from which you can furnish me with a statement showing, approximately, the number of acres in your county planted, respectively, to? That is to say:

Product.	No. of Acres.	Product.	No. of Acres.	Product.	No. of Acres.
Wheat	--------	Barley	--------	Oats	--------
Rye	--------	Corn	--------	Hay	--------
Apples	--------	Almonds	--------	Apricots	--------
Cherries	--------	Figs	--------	Olives	--------
Peaches	-------	Pears	--------	Plums	--------
Prunes	--------	Vegetables	--------	Lemons	--------
Limes	--------	Oranges	--------	Blackberries	--------
Raspberries	--------	Strawberries	--------	Wine Grapes	--------
Raisin Grapes	--------	Table Grapes	--------		

Hoping an early reply, I am, yours very truly,

F. V. MEYERS,
Commissioner State Bureau of Labor Statistics.

The purpose here in view was to secure data relative to the products of the several counties at this time, and thus make comparison possible between production, acreage, etc., in 1886, and the same now, thereby showing any increase or decrease which may have occurred, and showing, too, the present magnitude of any industry in the State included in the inquiry, all of which could be but interesting to the wage-earners of the State as showing possible present and prospective opportunities for employment in different localities. It was also hoped that the data obtained might be made the basis of close estimate as to the number of persons finding employment within the State in the various industries included, and as to the number of aliens thus finding employment.

As is often the case where attempt is made to secure data by correspondence, the result of this effort has been somewhat disappointing. The first copy of the communication when sent brought a certain number of replies promptly. In due time a duplicate copy was sent, which brought a certain number more of replies, and in due time again a third copy was sent to all from whom replies had not been received, with result that of the fifty-seven counties in the State there remains at this writing eleven whose Assessors have either neglected or refused to furnish the information asked. The said counties are: Alameda, Amador, Butte, Colusa, Contra Costa, Fresno, Merced, Monterey, Sacramento, San Joaquin, Siskiyou. The failure of the Assessors of these counties to respond is all the more regrettable from the fact that some of the said counties are among the most important in the State, and as the report of this Bureau is sent all over the United States, and indeed to almost all parts of the world, data of this kind are always interesting in distant places.

Another factor which goes to mar the completeness of the comparisons and showing sought to be here made is the incompleteness of the data of 1886.

It will be borne in mind, too, that some of the counties of the State have decreased in size, and that new counties have in some cases been created out of the territory of others, which in case of the county losing territory must be remembered in viewing apparent great falling off in its products.

However, much in the following table will be found interesting, and it is hoped that it can be made the basis for more complete statistical information on the same subject hereafter:

COMPARISON BETWEEN 1886 AND 1899 AS REGARDS LEADING AGRICULTURAL,

Products.	Alpine.		Calaveras.		Del Norte.		El Dorado.		Glenn.	
	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Almonds	------	------	------	20	------	------	------	24	------	150
Apples	------	20	------	100	------	79	------	32	------	115
Apricots	------	------	------	25	------	------	------	27	------	270
Barley	113	50	9,000	1,500	------	45	3,994	1,921	------	28,000
Blackberries	------	------	------	1	------	------	------	------	------	50
Cherries	------	------	------	5	------	5	------	40	------	14
Corn	8	20	600	25	------	75	------	5	------	4,000
Figs	------	------	------	10	------	------	------	16	------	90
Grapes (raisin)	------	------	------	10	------	------	44	100	------	150
Grapes (table)	------	------	750	50	------	------	900	205	------	100
Grapes (wine)	------	------	620	1,000	------	------	500	910	------	750
Hay	------	2,400	11,000	10,000	------	1,600	------	6,593	------	10,000
Lemons	------	------	------	2	------	------	------	2	------	60
Oats	236	200	------	150	------	860	1,706	1,285	------	50
Olives	------	------	------	50	------	------	------	14	------	49
Oranges	------	------	------	2	------	------	------	15	------	85
Peaches	------	------	------	75	------	1	------	1,303	------	290
Pears	------	5	------	10	------	7	------	580	------	280
Plums	------	20	------	5	------	------	------	------	------	50
Prunes	------	------	------	5	------	13	------	392	------	570
Raspberries	------	------	------	1	------	------	------	------	------	25
Rye	------	------	------	------	------	------	------	------	------	------
Strawberries	------	------	------	1	------	------	------	------	------	------
Walnuts	------	------	------	------	------	------	------	------	------	------
Wheat	179	340	27,000	1,500	------	------	6,060	1,612	------	165,000
Vegetables	------	25	------	100	------	------	------	------	------	100

COMPARISON BETWEEN 1886

Products.	Los Angeles.		Madera.		Marin.		Mariposa.		Mendocino.	
	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Almonds	------	1,283	------	20	------	2	------	12	------	10
Apples	------	721	------	20	------	1,550	------	350	------	3,000
Apricots	------	2,179	------	200	------	60	------	8	------	------
Barley	------	18,140	------	30,000	------	------	------	2,000	------	6,000
Blackberries	------	------	------	------	------	------	------	100	------	------
Cherries	------	63	------	------	------	5	------	6	------	------
Corn	------	1,261	------	------	------	------	------	200	------	400
Figs	------	119	------	40	------	------	------	12	------	------
Grapes (raisin)	------	119	------	1,500	------	------	------	100	------	29
Grapes (table)	------	306	------	200	------	------	------	200	------	600
Grapes (wine)	------	2,991	------	1,000	------	420	------	500	------	440
Hay	------	13,946	------	1,000	------	11,895	------	6,000	------	100,000
Lemons	------	2,518	------	------	------	------	------	5	------	------
Oats	------	1,676	------	------	------	------	------	200	------	9,000
Olives	------	2,224	------	40	------	------	------	100	------	------
Oranges	------	7,744	------	------	------	4	------	30	------	------
Peaches	------	3,086	------	400	------	45	------	70	------	2,000
Pears	------	352	------	50	------	50	------	40	------	54
Plums	------	57	------	------	------	------	------	10	------	------
Prunes	------	2,721	------	150	------	25	------	36	------	450
Raspberries	------	------	------	------	------	------	------	50	------	------
Rye	------	------	------	------	------	------	------	100	------	------
Strawberries	------	------	------	------	------	------	------	50	------	------
Walnuts	------	1,821	------	------	------	------	------	------	------	------
Wheat	------	19,225	------	150,000	------	------	------	900	------	15,000
Vegetables	------	------	------	------	------	------	------	500	------	------

VITICULTURAL, ETC., PRODUCTS IN THE SEVERAL COUNTIES OF THE STATE.

HUMBOLDT.		INYO.		KERN.		KINGS.		LAKE.		LASSEN.	
1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.
Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
-------	-------	-------	1	-------	20	-------	-------	-------	60	-------	-------
-------	-------	-------	156	-------	100	-------	21	82	200	-------	338
-------	-------	-------	7	-------	200	-------	1,062	-------	20	-------	3
471	1,930	1,364	350	-------	4,000	-------	8,470	-------	2,614	11,005	1,600
-------	-------	-------	-------	-------	-------	-------	25	-------	25	-------	200
-------	-------	-------	7	-------	10	-------	-------	-------	10	-------	7
-------	505	1,312	2,500	-------	1,800	-------	1,500	-------	1,000	-------	150
-------	-------	-------	1	-------	125	-------	-------	2	8	-------	-------
-------	-------	-------	25	-------	1,000	-------	6,000	-------	20	-------	-------
-------	-------	-------	25	-------	100	-------	100	-------	500	-------	-------
-------	-------	-------	20	-------	-------	-------	180	1,083	180	-------	-------
1,494	25,000	-------	15,000	-------	6,500	-------	6,000	-------	7,334	2,900	5,600
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
3,372	6,725	965	1,000	-------	100	-------	-------	-------	2,086	2,750	2,370
-------	-------	-------	-------	-------	30	-------	-------	-------	20	-------	-------
-------	-------	-------	-------	-------	40	-------	-------	-------	-------	-------	-------
-------	-------	-------	60	-------	350	-------	2,010	40	-------	-------	6
-------	-------	-------	21	-------	150	-------	419	15	-------	-------	10
-------	-------	-------	10	-------	20	-------	100	16	-------	-------	9
-------	-------	-------	40	-------	800	-------	1,000	-------	-------	-------	5
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	200
-------	60	-------	-------	-------	-------	-------	-------	-------	-------	-------	2,700
-------	-------	-------	-------	-------	5	-------	10	-------	-------	-------	200
-------	-------	-------	5	-------	-------	-------	-------	-------	-------	-------	-------
699	800	1,180	3,000	-------	25,000	-------	29,685	-------	-------	9,756	95,000
-------	-------	-------	100	-------	500	-------	250	-------	-------	-------	1,000

AND 1899—Continued.

MODOC.		MONO.		NAPA.		NEVADA.		ORANGE.		PLACER.	
1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.
Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
-------	-------	-------	-------	-------	15	-------	1	-------	-------	-------	20
-------	150	-------	40	-------	200	-------	250	-------	200	-------	118
-------	5	-------	5	-------	-------	-------	5	-------	2,000	-------	62
-------	11,167	-------	60	2,993	2,000	-------	-------	-------	40,000	23,980	5,600
-------	5	-------	5	-------	100	-------	10	-------	300	-------	75
-------	10	-------	10	-------	15	-------	5	-------	-------	-------	95
-------	-------	-------	10	1,031	3,500	-------	20	-------	4,000	-------	-------
-------	-------	-------	-------	-------	1	-------	3	-------	100	-------	29
-------	-------	-------	-------	-------	200	-------	20	-------	100	-------	165
-------	-------	-------	-------	-------	150	10	20	-------	-------	931	615
-------	-------	-------	-------	14,190	2,500	189	200	-------	700	1,000	250
-------	44,870	-------	20,000	6,578	50,000	5,978	2,000	-------	10,000	-------	21,000
-------	-------	-------	-------	-------	-------	-------	2	-------	1,000	-------	2
-------	300	-------	40	1,888	2,500	-------	-------	-------	5,000	27,155	1,000
-------	-------	-------	-------	-------	10	-------	40	-------	1,300	-------	175
-------	-------	-------	-------	-------	1	-------	2	-------	5,000	-------	80
-------	5	-------	-------	-------	50	-------	150	-------	600	-------	3,922
-------	10	-------	5	-------	45	-------	300	-------	60	-------	606
-------	10	-------	10	-------	60	-------	5	-------	-------	-------	253
-------	-------	-------	-------	-------	400	-------	50	-------	700	-------	107
-------	5	-------	5	-------	175	-------	10	-------	25	-------	75
-------	200	-------	-------	-------	150	-------	-------	-------	-------	-------	200
-------	3	-------	10	-------	75	-------	5	-------	200	-------	50
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
-------	14,000	-------	30	23,550	1,200	-------	-------	-------	25,000	50,470	19,500
-------	75	-------	120	-------	500	-------	100	-------	500	-------	100

COMPARISON BETWEEN 1886

Products.	PLUMAS.		RIVERSIDE.		SAN MATEO.		SANTA BARBARA.		SANTA CLARA.	
	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Almonds	------	------	------	410	------	6	------	22	------	196
Apples	------	50	------	80	------	235	------	260	------	241
Apricots	------	5	------	1,500	------	114	------	155	------	5,452
Barley	------	4,000	------	4,000	------	4,000	29,460	34,140	------	12,823
Blackberries	------	7	------	50	------	20	------	------	------	215
Cherries	------	2	------	20	------	14	------	------	------	1,557
Corn	------	------	------	------	------	300	1,680	1,440	------	187
Figs	------	------	------	10	------	1	------	------	------	22
Grapes (raisin)	------	------	------	550	------	------	------	------	------	------
Grapes (table)	------	------	------	70	------	------	------	------	------	680
Grapes (wine	------	------	------	------	------	170	------	------	------	11,068
Hay	------	12,000	------	3,750	------	20,000	------	35,120	------	30,917
Lemons	------	------	------	1,500	------	1	------	1,428	------	12
Oats	------	5,000	------	50	------	3,000	67	------	------	74
Olives	------	------	------	1,340	------	60	------	340	------	159
Oranges	------	------	------	10,325	------	1	------	26	------	16
Peaches	------	5	------	1,360	------	12	------	83	------	5,427
Pears	------	10	------	250	------	40	------	25	------	1,411
Plums	------	20	------	720	------	------	------	------	------	477
Prunes	------	------	------	220	------	370	------	45	------	32,762
Raspberries	------	12	------	------	------	20	------	------	------	139
Rye	------	------	------	------	------	------	------	------	------	------
Strawberries	------	15	------	75	------	175	------	------	------	265
Walnuts	------	------	------	------	------	------	------	------	------	116
Wheat	------	2,500	------	5,000	------	1,600	58,720	32,400	------	12,769
Vegetables	------	150	------	------	------	------	------	------	------	------

COMPARISON BETWEEN 1886

Products.	SIERRA.		SOLANO.		SONOMA.		STANISLAUS.		SUTTER.	
	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Almonds	------	------	------	30,000	------	5	------	50	------	309
Apples	------	50	------	200	------	2,000	------	75	------	140
Apricots	------	------	------	30,000	------	188	------	88	------	153
Barley	------	3,500	------	41,730	------	2,640	------	28,700	13,735	18,131
Blackberries	------	2	------	------	------	------	------	5	------	------
Cherries	------	10	------	3,000	------	381	------	------	------	10
Corn	------	------	------	------	------	1,210	------	175	140	51
Figs	------	------	------	50	------	272	------	35	------	53
Grapes (raisin)	------	------	880	------	------	------	------	140	50	379
Grapes (table)	------	------	1,000	318	------	260	------	30	100	12
Grapes (wine)	------	------	1,000	820	------	1,560	------	87	------	4
Hay	------	24,000	------	13,810	------	43,620	------	4,500	------	11,844
Lemons	------	------	------	20	------	------	------	1	------	2
Oats	------	1,500	------	800	------	6,240	------	245	1,208	790
Olives	------	------	------	35	------	------	------	58	------	21
Oranges	------	------	------	1,000	------	59	------	47	------	5
Peaches	------	5	------	35,000	------	775	------	219	------	1,523
Pears	------	2	------	20,000	------	1,424	------	47	------	182
Plums	------	------	------	9,840	------	200	------	------	------	114
Prunes	------	------	------	25,000	------	4,950	------	169	------	383
Raspberries	------	1	------	------	------	------	------	------	------	------
Rye	------	200	------	------	------	------	------	9,500	------	------
Strawberries	------	2	------	------	------	------	------	5	------	------
Walnuts	------	------	------	------	------	------	------	------	------	------
Wheat	------	325	------	93,060	------	12,000	------	305,270	99,182	90,486
Vegetables	------	50	------	------	------	------	------	10	------	------

AND 1899—Continued.

SANTA CRUZ.		SAN BENITO.		SAN BERNARDINO		SAN DIEGO.		SAN LUIS OBISPO.		SHASTA.	
1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.
Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
-------	4	-------	70	-------	70	108	400	-------	50	-------	40
-------	4,203	-------	100	-------	132	227	1,000	-------	718	-------	400
-------	508	-------	300	-------	1,091	863	1,200	-------	531	-------	5
-------	2,918	-------	16,200	-------	-------	-------	4,530	-------	142,500	3,531	2,269
-------	-------	-------	-------	-------	-------	-------	-------	-------	50	-------	50
-------	253	-------	35	-------	51	9	550	-------	117	-------	7
-------	2,757	-------	-------	-------	-------	-------	420	-------	1,060	-------	79
-------	6	-------	-------	-------	43	692	450	-------	30	-------	5
-------	-------	-------	-------	-------	5,000	-------	5,850	-------	-------	-------	155
-------	592	-------	16	-------	100	-------	400	-------	1,830	75	170
-------	1,072	-------	171	-------	3,000	-------	450	-------	975	75	200
-------	15,464	-------	6,320	-------	-------	-------	12,500	-------	62,800	175	17,649
-------	1	-------	-------	-------	700	571	7,000	-------	177	-------	-------
-------	5,143	-------	-------	-------	-------	-------	4,110	-------	9,200	3,820	206
-------	28	-------	-------	-------	810	460	2,200	-------	33	-------	70
-------	2	-------	-------	-------	10,434	962	2,500	-------	41	-------	-------
-------	287	-------	165	-------	2,500	225	7,500	-------	800	-------	1,697
-------	270	-------	130	-------	305	191	600	-------	438	-------	155
-------	-------	-------	-------	-------	-------	32	-------	-------	-------	-------	100
-------	2,449	-------	800	-------	1,120	112	2,000	-------	2,412	-------	2,443
-------	-------	-------	-------	-------	-------	-------	-------	-------	12	-------	-------
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	48
-------	-------	-------	-------	-------	-------	-------	-------	-------	33	-------	-------
-------	53	-------	-------	-------	75	214	500	-------	277	-------	9
-------	2,325	-------	12,560	-------	-------	-------	5,000	-------	365,750	6,746	6,046
-------	-------	-------	40	-------	-------	-------	-------	-------	-------	-------	100

AND 1899—Continued.

TEHAMA.		TRINITY.		TULARE.		TUOLUMNE.		YOLO.		YUBA.	
1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.	1886.	1899.
Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
-------	546	-------	-------	-------	35	-------	5	-------	723	-------	71
-------	184	-------	70	-------	219	-------	80	-------	14	-------	81
-------	575	-------	1	-------	572	-------	20	-------	766	-------	218
18,750	25,380	-------	50	-------	75,850	-------	4,200	5,000	34,848	10,660	9,725
-------	-------	-------	-------	-------	-------	-------	10	-------	-------	-------	-------
-------	68	-------	4	-------	-------	-------	65	-------	35	-------	116
150	12	-------	100	-------	1,060	-------	60	-------	20	-------	50
-------	108	-------	-------	-------	73	-------	3	-------	138	-------	64
-------	406	-------	-------	-------	2,965	-------	-------	2,000	6,761	100	100
528	354	-------	-------	-------	-------	-------	10	-------	-------	25	40
4,000	2,920	-------	-------	-------	-------	-------	50	746	-------	125	200
-------	24,910	-------	10,000	-------	7,450	-------	8,300	-------	7,078	-------	18,820
-------	-------	-------	-------	-------	745	-------	-------	-------	3	-------	55
7,385	1,650	68	200	-------	740	-------	440	-------	30	1,550	4,155
-------	52	-------	-------	-------	53	-------	-------	-------	45	-------	94
-------	-------	-------	-------	-------	3,515	-------	-------	-------	15	-------	622
-------	4,876	-------	12	-------	3,359	-------	100	-------	651	-------	1,017
-------	427	-------	4	-------	240	-------	5	-------	314	-------	202
-------	-------	-------	-------	-------	-------	-------	50	-------	1,065	-------	-------
-------	678	-------	10	-------	4,203	-------	-------	-------	-------	-------	261
-------	-------	-------	-------	-------	-------	-------	10	-------	-------	-------	-------
-------	-------	-------	50	-------	-------	-------	10	-------	-------	-------	-------
-------	-------	-------	-------	-------	-------	-------	5	-------	-------	-------	-------
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	21
120,000	47,090	827	500	-------	384,975	-------	4,500	145,000	194,660	29,805	39,856
-------	-------	-------	200	-------	-------	-------	200	-------	-------	-------	-------

The foregoing table has been, as said, made as complete as the data, which earnest effort has been able to obtain, have allowed. It is to be regretted that the report of 1886 is so meager, and even more to be regretted that the Assessors of so many of the important counties neglected to make returns as before described, for it is plain that with more completeness the table would be valuable as a source of information abroad regarding the extent to which the productions enumerated are produced in the various counties, and as an index from which the wage-earner might readily estimate the chances for employment in a given industry in a given county during the different seasons of the year. As it is, some interesting comparisons are permitted; one of which is the frequency, where comparison is possible between the years 1886 and 1899, with which a less acreage appears as sown to grain products, and a greater acreage appears as planted to fruits, vines, etc. In the matter of wheat, it will be noted that Tulare County leads in acreage sown, it having reported 384,975 acres in 1899. In the matter of hay, Mendocino leads with 100,000 acres, and San Luis Obispo and Sonoma follow with 62,800 and 43,620 acres, respectively. In corn the largest acreage reported from any county is 4,000 acres, which acreage is reported from both Glenn and Orange counties. In prunes, Santa Clara County leads by all odds, with 32,762 acres; Santa Cruz County has 2,449 acres, and Shasta County has 2,443 acres. Solano County reports 30,000 acres of almonds, and Los Angeles County comes next, with 7,283 acres. Walnuts are scarce so far as reports were made; Los Angeles County appearing with 1,821 acres, Santa Barbara County with 75 acres, and Yuba County with 21 acres. The aggregate acreage sown to wheat, as reported in 1899, is 2,161,524 acres, and it must be remembered that this vast sum by no means represents the entire acreage sown to wheat, since some of the counties from which no reports were returned as named, are among the principal wheat-producing counties in the State.

The great increase in variety of products, however, shown as occurring between the years 1886 and 1899, can be but gratifying to wage-earners, since, in connection with the work necessarily required to plant, cultivate, and harvest the several crops during the appropriate recurring seasons, promise is thereby given of more, and more permanent, employment, throughout the entire year.

Comparison Between Prevailing Wages and Hours of Labor in Various Avocations in the Following Several States.

OCCUPATION.	CALIFORNIA.			INDIANA.			MICHIGAN.		
	Hours per Day.	Wages. Day.	Wages. Month.	Hours per Day.	Wages. Day.	Wages. Month.	Hours per Day.	Wages. Day.	Wages. Month.
Bakers	13	$2 00b		11	$2 00		10	$2 00	
Barbers	12	2 00		12	1 75		12	1 85	
Blacksmiths	10	3 25		10	2 50		9	2 25	
" Helpers	10	2 25		10	1 35		10	1 40	
Boilermakers	10	3 50		10	2 60		10	2 42	
" Helpers	10	2 25		10	1 35		10	1 40	
Bookbinders	10	3 00		9½	2 75		10	1 50	
Boxmakers	10	1 75		10	1 20		10	1 47	
Brass-finishers	10	3 50		10	2 20		10	2 25	
Brewers	9	2 80		10	2 50		9	2 33	
Bricklayers	8	5 00		8	4 00		8	2 15	
Butchers	14	2 60		12	2 25		10	1 87	
Cabinetmakers	9	2 75		10	1 75		9	1 92	
Canmakers	10	2 50		10	2 13		10	1 25	
Candymakers	10	2 50		10	2 10		10	1 50	
Carpet-layers	10	3 50					10	1 82	
Carriage-trimmers	10	2 75		10	1 90		10	1 66	
Cigarmakers	8	2 25		8	1 90		8	1 82	
Cigarbox-makers	10	2 00					10	1 11	
Coatmakers	12	3 00		10	2 10		10	96	
Concrete-workers	8	3 00							
Conductors, Railroad		3 75			3 50		8		$120 00
" Street Railroad		2 25		12	1 85		10	1 75	
Coopers	10	2 75		10	1 31		10	2 13	
Coppersmiths	10	3 75					9	1 08	
Carpenters	8	3 50		9	2 40		9	2 00	
Cutters, Cloth	10	3 50		10	1 86		10	2 50	
Domestics			$18 00						14 75
Draughtsmen	8	4 50		10	2 18			4 00	
Drapers	9	3 00							
Dressmakers	9	1 60					10	1 25	
Drygoods Clerks (male)	10		65 00	10		$37 00	10	1 52	
" " (female)			26 00				10	87	
Electricians	8	2 75		8	2 60		10	2 00	
Electrotypers	10	3 25					9	1 64	
Elevator Men	11		35 00				12	1 50	
Engineers, Railroad			125 00		3 75		8		100 00
" Stationary	12	2 50		10	2 00		10½	2 12	
Express Drivers	12	2 50		12	2 09		10½	1 33	
Firemen, Railroad			75 00		2 00		8		70 00
" Stationary	12	2 00					11	1 62	
Gasfitters	8	4 00		9	2 85		10	2 12	
Glassblowers	8	4 50		9	4 50				
Glove-cutters	9½	2 50							
Glovemakers (male)	9½	3 00					9	1 06	
" (female)	8	1 25					9	1 06	
Grainers	8	3 75		9½	2 35				
Granite-cutters	8	3 60		8	3 60		9	1 50	
Granite letter-cutters		4 00					10	4 00	
Harnessmakers, Jobbing	10	2 25							
" Factory	10	1 25		9½	1 95		10	1 65	
Hackmen	12	2 00					13	1 65	
Hodcarriers	8	3 00		8½	2 00		10		
Horseshoers	9	2 75		10	2 50		10	2 50	
" Helpers	9	2 00					10	1 05	
Ironworkers, Construction	8	2 75		10	2 28		10	1 56	
" Ornamental	10	2 50		10	2 28		10	1 56	
Jewelers	10	3 50					9	2 10	
Laborers, Building	8	2 50		10	1 50		10	1 27	
" Street	9½	1 85		10	1 50		10	1 40	
" Railroad	10	1 30		10	1 30		10	1 32	
" Agricultural	11	1 00							16 42
" Mine	10	2 00		8	1 75		10	1 50	
Lasters, Shoe	10	1 75					9	1 66	
Lathers	8	3 00		9	2 50				
Laundries	12		35 00	10	80		10	85	
Linotypers	9	4 00		9	2 75		9	4 25	
Linemen	10	2 75					10	1 36	
Machinists	10	3 25		9½	2 40		9	2 47	
" Apprentices	10	1 00		10	73				
Marble-cutters	9	3 00		10	2 61		9	3 00	
" Letter-cutters		3 00		9	2 38		10	3 50	
" Polishers	9	2 00		8	1 42		10	3 50	
Marine, Chief Engineers			137 50						
" First Engineers			100 00						
" Second Engineers			85 00						
" Third Engineers			75 00						
" Electrical Engineers			65 00						
" Deck Engineers			70 00						
" Oilers			50 00						
" Water-tenders			55 00						
" Plumbers			60 00						
" Firemen			50 00						
" Coal-passers			35 00						
Messenger Boys	10	1 00							
Milkers	14		35 00						
Milliners	9	2 50		9½	1 12		10	1 80	
Miners	10	3 25		8	2 12		8	1 95	
Molders	10	3 25		9½	2 27		9	2 51	
Orchard Men, Pruners	10	2 00							
" Fruit Packers	11	1 50							
Painters	8	3 00		9	2 25		10	2 00	
Paperhangers	8	3 50					10	2 00	
Paperrulers	8	3 75							
Patternmakers	10	3 50		10	2 30		10	2 50	
Planing-mill Hands	9	2 50		9½	2 25		10	1 33	
Plasterers	8	4 00		9	3 00		10	4 00	
Plumbers	8	4 00		10	2 00		9	2 00	
Polishers, Wood	9	2 50		10	1 35		10	1 60	
Potterymen	10	3 50		10	2 05				
Printers	10	3 00		10	2 00		9½	1 65	
Pressmen	10	3 00		10	2 00				
Quarrymen	10	2 50		10	1 28				
Ropemakers (male)	10	1 70							
" (female)	10	1 25							
Sandstone-carvers	8	4 75							
" -cutters	8	4 00		9	3 60		10	3 40	
Shoemakers	9	1 75					9	1 41	
Ship Captain			175 00						
" Calkers	9	5 00		10	2 20		10	1 61	
" Carpenters	9	5 00		10	1 95		10	1 61	
" Joiners	9	4 00		10	1 91		10	1 61	
" Mates			65 00						
" Riggers	9	4 00							
" Sailors			47 50						
Sailmakers	9	4 00							
Springmakers	9	3 00		9	2 25		10	1 54	
Stablemen	14		30 00				12	1 25	
Stairbuilders	8	4 00		9	2 25		9	2 00	
Station Agents, Railroad	12		100 00						75 00
Stereotypers	9	4 00							
" Assistants	9	2 60							
Stevedores	9	2 70		10	2 00		9	4 00	
Street-car Men	11	2 42		12	1 80		10	1 75	
Street-pavers	8	4 00					10	2 38	
" " Helpers	8	2 00					10	1 75	
Teamsters	11	2 25		11	1 60		10½	1 33	
Telegraph Press Operators	10		90 00						
" Message Operators	10		65 00				12	1 49	
" Female Operators	10		30 00						
" Associated Press Operators	8		120 00						
" Train Dispatcher	8		140 00						
" " " (operator)	8		90 00						
Tile Masons, Street	9½	3 00							
Tobacco-strippers (male)	8	1 00							
" " (female)	8	1 00		10	58		9	85	
Tile-setters	8	3 75							
Trousers-makers (male)	10	2 25		10	1 60		10	1 25	
" " (female)	10	1 50					9½	2 25	
Upholsterers	9	3 00		9	1 83				
Typewriter Repairers	9	2 50							
Typewriters (male)	8		65 00				8½	1 18	
" (female)	8		40 00						
Vestmakers (male)	10	2 00		10	1 60		10	80	
" (female)	10	1 60					10	2 18	
Wagonmakers	10	2 75		10	1 75				
Watchmakers	10	3 00					8	3 33	
Woodcarvers	8	3 50		8½	2 00		10	1 29	
Wooden Mill Hands (male)	11	2 00		11	2 00		10	1 29	
" " " (female)	11	1 25		11	75				
Wool-scourers	10	2 00							
Wool-sorters (male)	10	2 10		10	1 21				
" " (female)	10	1 00							

OCCUPATION.	MONTANA.			NEBRASKA.		
	Hours per Day.	Wages. Day.	Wages. Month.	Hours per Day.	Wages. Day.	Wages. Month.
Bakers	12	$3 00		12	$2 00	
Barbers	12	2 75		12	1 60	
Blacksmiths	10	4 20		10	2 15	
" Helpers	10	3 15		10	1 60	
Boilermakers	10	4 00		9	2 78	
" Helpers	10	2 95		9	1 60	
Bookbinders				9	2 00	
Brass-finishers				10	3 00	
Brewers	10	3 60		10½	2 12	
Bricklayers	9	6 00		10	3 00	
Butchers	12	3 60		10	2 25	
Cabinetmakers				10	1 75	
Canmakers				10	1 50	
Candymakers				10	2 00	
Carpet-layers				10	2 00	
Carriage-trimmers				10	2 25	
Cigarmakers	8	3 00		8	2 21	
Cigarbox-makers				10	2 00	
Coatmakers	10	3 50		9½	1 58	
Concrete-workers				10	3 00	
Conductors, Railroad					3 20	
" Street Railroad				10	1 50	
Coopers	10	3 75		10	2 30	
Coppersmiths				8	3 00	
Carpenters	9	4 00		9	2 25	
Cutters, Cloth				10	1 66	
Domestics			$22 71			$14 00
Draughtsmen	10	5 40				
Drapers				9		60 00
Dressmakers				10	1 17	
Drygoods Clerks (male)	10		80 00	12	1 50	
" " (female)	10		50 00	12	80	
Electricians	10	3 75		10	3 00	
Electrotypers	10	2 40		10	3 00	
Engineers, Railroad		3 50			3 49	
" Stationary	10	3 50		12	2 75	
Express Drivers				12	1 50	
Firemen, Railroad		2 50			2 15	
" Stationary	10	3 00		12	1 75	
Gasfitters				10	2 25	
Grainers				9	2 70	
Granite-cutters	10	4 50		10	2 00	
Granite letter-cutters				10	3 00	
Harnessmakers, Factory				10	1 27	
Hodcarriers				10	1 50	
Horseshoers				10	2 50	
" Helpers				10	1 50	
Ironworkers, Construction				10	2 50	
" Ornamental				10	2 50	
Jewelers				10	2 50	
Laborers, Building	10	3 00		10	1 40	
" Street	10	2 25		10	1 50	
" Railroad				10	1 40	
" Agricultural			31 00	12	94b	
" Mine	10	2 75				
Lathers				9	2 00	
Laundries		2 25		9	1 00	
Linotypers				9	3 00	
Linemen	10	3 00		10	2 50	
Machinists	10	3 75		8	3 13	
" Apprentices	10	2 25		8	1 51	
Marble-cutters				9½	2 25	
" Polishers				9½	2 00	
Messenger Boys				10	50	
Milkers				12		20 00
Milliners				10		40 00
Miners	10	3 10				
Molders	10	3 95		9	3 00	
Painters	10	4 25		10	2 00	
Paperhangers				9	2 70	
Patternmakers	10	4 65		10	2 75	
Planing-mill Hands				10	1 25	
Plasterers	8	4 00		10	2 25	
Plumbers				9½	2 50	
Potterymen				10	2 00	
Printers	9	4 50		10	2 00	
Pressmen				10	1 31	
Quarrymen	9	3 50		10	1 50	
Sandstone-cutters	10	4 50		10	2 60	
Stablemen	14		65 00	13		18 00b
Stairbuilders				10	3 00	
Station Agents, Railroad				12	1 67	
Stereotypers				10	2 60	
" Assistants				10	1 50	
Street-car Men	11	2 75		11	1 65	
Street-pavers				10	4 00	
" " Helpers				10	1 75	
Teamsters	12	2 75		11	1 60	
Telegraph Press Operators				9		60 00
" Message Operators				10	1 89	
" Train Dispatcher						120 00
" " " (operator)				5		50 00
Tile Masons, Street				10	2 00	
Tobacco-strippers (female)				8	50	
Tile-setters				10	2 50	
Trousers-makers (male)				9½	1 25	
" " (female)				8	2 95	
Typewriter Repairers				10	2 00	
Typewriters (male)				10	1 50	
Vestmakers (female)				10	2 50	
Wagonmakers				12	1 07	
Watchmakers				10	3 25	

OCCUPATION.	NORTH CAROLINA.			NEW YORK.			VIRGINIA.		
	Hours per Day.	Wages. Day.	Wages. Month.	Hours per Day.	Wages. Day.	Wages. Month.	Hours per Day.	Wages. Day.	Wages. Month.
Bakers				12	$2 25		10	$0 85	
Barbers				12	1 65				
Blacksmiths				9	3 50		10	1 77	
" Helpers				9	1 90		10	1 05	
Boilermakers				9	3 00		10	2 23	
" Helpers				9	1 90		10	1 35	
Bookbinders				10	2 50		9 7/10	2 06	
Boxmakers							9	1 14	
Brass-finishers				10	2 50				
Brewers				10	2 50		11	2 85	
Bricklayers				8	4 00		9	3 50	
Butchers				11	2 00				
Cabinetmakers	10	$1 13		9	2 50		10	1 60	
Candymakers				10	2 50		10	2 00	
Carpet-layers							10	1 00	
Carriage-trimmers				10	1 83		10	1 35	
Cigarmakers	8	1 27		8	2 00		8 3/8	1 64	
Cigarbox-makers							9	1 14	
Coatmakers				10	2 00		10	1 60	
Concrete-workers				8	2 25				
Conductors, Railroad		3 03		11	3 15			2 92	
" Street Railroad				12	2 00		11	1 50	
Coopers				10	3 00		9½	1 81	
Coppersmiths				9	3 00		10	2 02	
Carpenters	10	1 31		8	3 50		10	1 56	
Cutters, Cloth				9	3 00		10	3 25	
Domestics							14		$6 00b
Draughtsmen							9½	2 38	
Dressmakers								1 00	
Drygoods Clerks (male)				11	2 00		10		40 00
" " (female)				11	1 60		10		30 00
Electricians				10	2 50		10	2 00	
Electrotypers				9	3 50		9½	2 10	
Elevator Men							10		40 00
Engineers, Railroad		3 00		12	3 75			4 07	
" Stationary	11	1 39		11	3 60		11	1 60	
Express Drivers				10	2 50				
Firemen, Railroad		1 40		11	2 00			1 88	
" Stationary	11	95		12	2 00		12	1 30	
Gasfitters				9	3 00		9	2 75	
Glassblowers				8½	4 00				
Glove-cutters				10	2 25				
Granite-cutters	10	3 00		8	3 60		10	1 50	
Granite letter-cutters							9	2 75	
Harnessmakers, Factory							10	1 04	
Hackmen				14	2 00		12		
Hodcarriers				8	2 75		9	1 50	
Horseshoers				10	2 75				25 00
" Helpers				10	1 75				
Ironworkers, Construction				9	2 25				
" Ornamental				9	2 25				
Laborers, Building				8	2 00		10	92	
" Street	11	79		8	1 80		10	65	
" Railroad	10	75					10	1 02	
" Agricultural			$8 00b				12		
" Mine	10	70					10	75	
Lasters, Shoe				10	2 00		10	1 25	10 00
Lathers				8	3 00				
Laundries				10	1 40		10		
Linotypers				8	4 25			3 00	
Linemen							10	1 25	20 00
Machinists	10	2 31		10	3 00		10	2 04	
" Apprentices				10	1 75		10	76	
Marble-cutters				8	4 00		9¾	1 94	
" Letter-cutters							9	2 75	
" Polishers				8	3 25		9¾	1 18	
Marine, Chief Engineers				8	2 75				
Messenger Boys									17 50
Milliners							10	1 75	
Miners	10	1 25					10	1 10	
Molders				10	3 25		10	1 96	
Painters				8	3 00		10	1 50	
Paperhangers				8	4 00		9	2 50	
Patternmakers				9	3 60		10	2 20	
Planing-mill Hands							10	1 75	
Plasterers				8	3 50		9	2 00	
Plumbers				8	3 50		9	2 75	
Polishers, Wood				8	3 00				
Printers				9	4 00		9 7/8	2 88	
Pressmen				10	4 00		9½	1 47	
Quarrymen	10	1 00		10	1 65		10	1 71	
Sandstone-carvers				8	4 50		9	2 75	
" -cutters	10	1 75		8	4 00		10	1 60	
Shoemakers				10	2 00		10	1 14	
Ship Calkers				9	3 25				
" Carpenters				9	3 25		10	1 90	
" Joiners				9	3 25		10	1 90	
" Riggers				9	3 50				
Sailmakers				9	3 00				
Stablemen				14	1 71		14		20 00
Stairbuilders				8	3 60				
Station Agents, Railroad	12	1 30						1 45	
Stereotypers				8	4 00				
Stevedores				8	2 25				
Street-car Men				12	2 00		11	1 94	
Street-pavers				8½	4 50		10	1 50	
" " Helpers				8½	3 50		10	1 00	
Teamsters				10	2 50		11	85	
Telegraph Message Operators	10	1 67						1 61	
Tile Masons, Street				8	3 00				
Tobacco-strippers (male)	10	64					10	50	
" " (female)	10	37		10	75		10	50	
Tile-setters				8	4 00				
Trousers-makers (male)				10	1 75				
" " (female)				10	1 75				
Upholsterers	10	1 13		10	2 50		10	1 30	
Typewriters (male)							10		45 00
" (female)							10		25 00
Vestmakers (male)				10	2 00				
" (female)				10	1 00				
Wagonmakers				10	1 83		10	1 15	
Woodcarvers				9	3 00				
Wooden Mill Hands (male)	10½	80					10	1 00	
" " " (female)	10½	40					10	65	
Wool-sorters (male)							10	95	
" " (female)							10	47	

b Including board.

Comparison Between Prevailing Wages and Hours of Labor in Various Avocations in the following Several Countries in Connection with the Table Showing Wages Paid in Like Avocations in the United States.

Occupation	England: Hours per Day	England: Wages, Day	England: Wages, Month	Germany: Hours per Day	Germany: Wages, Day	Germany: Wages, Month	France: Hours per Day	France: Wages, Day	France: Wages, Month	Switzerland: Hours per Day	Switzerland: Wages, Day	Switzerland: Wages, Month
Bakers	9½	$1 12					11	$1 25				
Blacksmiths	9	1 60		10½	$1 20		10½	1 65		10½	$0 87	
" Helpers	9	1 02								10	66	
Boilermakers	9	1 80		10½	1 20		10	1 20		10	79	
" Helpers	9	1 00								10	61	
Bookbinders				10	96		10	1 20		10	72	
Boxmakers												
Brass-finishers	9	1 40		10½	1 20		10	1 30				
Bricklayers	8½	1 67		10½	1 44		10	1 45		10	84	
Brewers	9	1 05		11½	1 20		11¼	96		10½	79	
Brickmakers		1 05								10½	63	
Butchers												
Cabinetmakers	8½	1 48					10	1 40				
Candymakers							11	1 06				
Carpenters	8½	1 67		10½	1 44		10¾	1 45		10	84	
Carriage-trimmers	9	1 20										
Chalk, Plaster, etc.										10½	63	
Chocolate-makers										10½	70	
Cigarmakers (male)				10	48							
" (female)				10	40							
Cigarette-makers												
Coach and Cart Builders		1 28								10	74	
Coatmakers		1 32										
Conductors, Railroad		97		12	56							
Coopers	9	1 47		10	1 25		10½	1 33		10	1 07	
Coppersmiths	9	1 52		10½	1 20		10½	1 40				
Coremakers		1 40								10	70	
Cutters, Cloth		2 61					10½	1 89				
Domestics			$11 00						$3 33			
Dressmakers, Fitters		2 00					10¾	75				
" Sewers		54					10½	40				
Electrotypers		1 44										
Engineers, Railroad		1 60					10	2 10			94	
" Stationary	9	1 44		12	1 20		11	88		10	79	
Express Drivers		1 00										
Firemen, Railroad		1 00		12	60						94	
" Stationary	9	1 00								10	79	
Glassblowers	8	1 36					10½	1 64				
Glovemakers (male)							11	1 13				
" (female)							11	60				
Grainers												
Granite-cutters	9	1 19					10½	62		10½	1 00	
Hackmen		80										
Harnessmakers	9	1 00					11½	1 40		10	64	
Hodcarriers	9	69					10	95		10	63	
Jewelers							10½	1 31				
Laborers, Agricultural			14 50						6 00			
" Building	9	97					10¾	59			63	$10 50
" Brick Kiln		80									57	
" Cotton Mills											50	
" Machine Shop	9	80									61	
" Mine		72		10½	61		9½	61				
" Railroad		84		11	48						62	
" Street	8	92			55						63	
Lasters		1 12										
Lathers		1 40										
Linemen				10	80							
Linotypers	8½	1 60					10	2 00				
Machinists	9	1 52		10½	1 20		10¾	1 27		10	76	
Marble-cutters							10	1 [illegible]				
Masons	9	1 53			1 44					10	83	
Milkers and Dairymen										10½	80	
Millers					1 20					10½	81	
Milliners		75					10½	52				
Miners		1 10		10	84		9½	87				
Molders	9	1 44		10½	1 20		10¾	1 50			82	
Painters	8½	1 42		10½	1 20		9	1 40		10	81	
Paperhangers				10½	1 20							
Paperrulers				10½	1 20							
Patternmakers	9	1 68		10½	1 20		10¾	1 66				
Planing-mill men	9	1 52		10½	1 10		10½	1 32				
Plasterers	8½	1 67		10½	1 44		10	1 36		10	83	
Plumbers	7¾	1 72					10¼	1 28				
Polishers, Wood	8½	1 20					10	1 15				
Potterymen		80		11	72		10½	1 57		10½	65	
Pressmen	9	1 36					10	1 35				
Printers	9	1 80		10	1 20		10	1 30		10	72	
Quarrymen	9	1 14		11	1 00		10½	84		10½	75	
Ropemakers (male)							10½	1 47				
" (female)												
Sailors		1 03				$12 96						
Sandstone-cutters	9	1 26					10	1 19				
Ship Carpenters		1 68										
" Calkers		1 32										
" Joiners	8½	1 57										
Sailmakers		1 32										
Shoemakers	9	1 06					11	1 13		10	65	
Springmakers							11	1 13				
Stereotypers	8½	1 44					10¼	82				
Stevedores	10	1 [illegible]		10	1 23							
Stone-cutters										10½	1 00	
Street-pavers	8¼	1 63					10	1 35			72	
" Helpers	8¼	85					10	95				
Teamsters	11	1 00					9½	78			70	
Tile-setters	9	1 65		10½	1 20							
Tinsmiths										10	80	
Trousers and Vest Makers		99										
Upholsterers	8½	1 60					10	1 90				
Wagonmakers		1 20					9¾	1 46				
Watchmakers							10¼	1 31				
Weavers, Cotton Cloth (male)										10½	50	
" " " (female)										10½	40	
Woodcarvers				10	1 20		10	1 80		10	69	
Woodchoppers											66	
Woodturners										10	62	
Woolen Mill Hands (male)		93					11½	63				
" " " (female)		53					11½	45				

Occupation	Denmark: Hours per Day	Denmark: Wages, Day	Denmark: Wages, Month	Belgium: Hours per Day	Belgium: Wages, Day	Belgium: Wages, Month	Austro-Hungary: Hours per Day	Austro-Hungary: Wages, Day	Austro-Hungary: Wages, Month	Sweden: Hours per Day	Sweden: Wages, Day	Sweden: Wages, Month
Bakers	11	$0 74								11½	$0 82	
Blacksmiths	10	84		11	$0 86			$1 00		10½	91	
" Helpers				11	57			62		10½	42	
Boilermakers	10½	84		10	77			1 00		10½	91	
" Helpers								51		10½	42	
Bookbinders	10	80								10½	83	
Boxmakers				11	81							
Brass-finishers	10½	84		10	84					10¼	91	
Bricklayers	9½	88		11	82							
Brewers	10½	82						51		11	52	
Brickmakers								37		11	63	
Butchers	11	89										
Cabinetmakers	10	80						47				
Candymakers								53				
Carpenters	9½	1 00		11	82			47		11	87	
Carriage-trimmers												
Chalk, Plaster, etc.										11	62	
Chocolate-makers										11½	78	
Cigarmakers (male)		80										
" (female)		53						27				
Cigarette-makers								31				
Coach and Cart Builders												
Coatmakers	10½	28						46		10½	1 17	
Conductors, Railroad												
Coopers	10	89										
Coppersmiths	10½	89		10½	60			1 23				
Coremakers										10½	49	
Cutters, Cloth										10½	1 17	
Domestics												
Dressmakers, Fitters	10	53										
" Sewers												
Electrotypers												
Engineers, Railroad												
" Stationary				11	82							
Express Drivers												
Firemen, Railroad	10	80										
" Stationary												
Glassblowers				10	3 20			83		10	1 16	
Glovemakers (male)		89										
" (female)		44										
Grainers				11	1 04							
Granite-cutters												
Hackmen												
Harnessmakers												
Hodcarriers	10	80										
Jewelers				10	1 15						42	
Laborers, Agricultural								28				
" Building		66		11	55							
" Brick Kiln										11	44	
" Cotton Mills											37	
" Machine Shop	10½	66		10	52			51			42	
" Mine				10	75			40			40	
" Railroad												
" Street												
Lasters												
Lathers												
Linemen												
Linotypers												
Machinists	9	84		10	84			1 00		10½	91	
Marble-cutters												
Masons												
Milkers and Dairymen										11	88	
Millers								40		11½	60	
Milliners												
Miners				10	1 00			60		10	93	
Molders	10	86		10	86			1 23		10½	91	
Painters	10	1 05		11	82					10½	1 14	
Paperhangers												
Paperrulers										10½	91	
Patternmakers	10½	86		10	1 05			92				
Planing-mill men	10½	98		11	73			35		11	70	
Plasterers	10	1 00		11	82							
Plumbers				11	82							
Polishers, Wood												
Potterymen	10½	80						50		11	76	
Pressmen								55		10	88	
Printers	10	92						55		10	88	
Quarrymen										10½	46	
Ropemakers (male)	10	80						38				
" (female)	10	32		10½	27			25				
Sailors												
Sandstone-cutters												
Ship Carpenters	9	85								10	68	
" Calkers										10	68	
" Joiners	9	80								10	68	
Sailmakers	9	89								10	68	
Shoemakers								37		10½	63	
Springmakers												
Stereotypers												
Stevedores												
Stone-cutters	10	1 06		11	82					11	67	
Street-pavers				11	82							
" Helpers				11	55							
Teamsters												
Tile-setters				11	71							
Tinsmiths								90		10½	62	
Trousers and Vest Makers								46		10½	45	
Upholsterers	10	1 06										
Wagonmakers	10½	80										
Watchmakers	10	84										
Weavers, Cotton Cloth (male)								38		11	86	
" " " (female)								26		11	42	
Woodcarvers	10¼	92		12	57							
Woodchoppers												
Woodturners												
Woolen Mill Hands (male)				10½	67			46				
" " " (female)				10½	50							

Occupation	Italy: Hours per Day	Italy: Wages, Day	Italy: Wages, Month	Portugal: Hours per Day	Portugal: Wages, Day	Portugal: Wages, Month	Mexico: Hours per Day	Mexico: Wages, Day	Mexico: Wages, Month	Japan: Hours per Day	Japan: Wages, Day	Japan: Wages, Month
Bakers							5	$0 32				
Blacksmiths	10	$0 75		12	$0 59		10	1 62			$0 24	
" Helpers												
Boilermakers	10	82			1 24		10	1 81				
" Helpers												
Bookbinders												
Boxmakers												
Brass-finishers												
Bricklayers							10	85				
Brewers												
Brickmakers											28	
Butchers												
Cabinetmakers							10	1 25				
Candymakers												$4 82
Carpenters		58					10	75			24	
Carriage-trimmers												
Chalk, Plaster, etc.												
Chocolate-makers												
Cigarmakers (male)	11	60			92							
" (female)												
Cigarette-makers												
Coach and Cart Builders												
Coatmakers		1 00			1 00							
Conductors, Railroad								2 75				
Coopers							10	1 00			19	
Coppersmiths												
Coremakers												
Cutters, Cloth		1 60			2 00							
Domestics								31				1 41
Dressmakers, Fitters												
" Sewers												
Electrotypers												
Engineers, Railroad		1 89						3 75				
" Stationary							10	1 25				
Express Drivers												
Firemen, Railroad		1 90										
" Stationary												
Glassblowers												
Glovemakers (male)												
" (female)												
Grainers												
Granite-cutters												
Hackmen												
Harnessmakers	11	60			58		10	81			23	
Hodcarriers												
Jewelers											21	
Laborers, Agricultural							11	34			15	
" Building		44										
" Brick Kiln												
" Cotton Mills												
" Machine Shop												
" Mine												
" Railroad		35										
" Street		44			18		10	31			17	
Lasters												
Lathers												
Linemen												
Linotypers												
Machinists	10	87		11	71		10	1 37				
Marble-cutters												
Masons	10	59			77							
Milkers and Dairymen												
Millers												
Milliners												
Miners	10	55		10	45		10	68			24	
Molders		94					10	1 17				
Painters	10	1 28			94		10	68				
Paperhangers												
Paperrulers												
Patternmakers							10	1 60				
Planing-mill men												
Plasterers							10	62			25	
Plumbers	11	58			87		10	1 87				
Polishers, Wood												
Potterymen												
Pressmen											17	
Printers	10	1 31			39		10	87			18	
Quarrymen	11	58		10	42		10	1 00				
Ropemakers (male)												
" (female)												
Sailors												
Sandstone-cutters												
Ship Carpenters											25	
" Calkers												
" Joiners											22	
Sailmakers												
Shoemakers								87			23	
Springmakers												
Stereotypers												
Stevedores												
Stone-cutters	11	61		10	92		10	1 25			27	
Street-pavers												
" Helpers												
Teamsters		41										
Tile-setters												
Tinsmiths											24	
Trousers and Vest Makers		1 00			1 00						29	
Upholsterers							10	56				
Wagonmakers												
Watchmakers												
Weavers, Cotton Cloth (male)												
" " " (female)												
Woodcarvers												
Woodchoppers												
Woodturners												
Woolen Mill Hands (male)		75			65						13	
" " " (female)		38									09	

N. B.—All wages paid in foreign currency reduced to their equivalent in United States money.
Data in reference to Italy and Portugal taken from years 1889 to 1897; in reference to Japan, from year 1897; in reference to Mexico, from year 1900; and as to other countries named, 1886 to 1900; that respectively in each country being the latest available.

PRESENT CONDITION OF WAGE-EARNERS IN CALIFORNIA,

As Compared with Conditions Heretofore, and in Other Places, and with Tables Showing Such Comparisons.

In gathering data for the accompanying tables, effort has been made to gather from States in such a way as would enable comparison to be made between wages paid in the respective avocations in the various several general localities of the United States, and again between the United States in general (including California in particular), and the various foreign countries as named. The tables are, of course, far from complete or as comprehensive as we would like to have them, and yet they contain a basis for some interesting comparisons. It is not intended here to draw conclusions so much as to suggest in some cases facts as they appear to be revealed by the said tables.

The figures given in regard to the respective States are taken, in the case of each State, from the latest available report of the Bureau of Labor Statistics of that State.

A fact first and most pleasingly apparent is that, as regards wages, the wage-earner of California is, in almost every avocation, better paid than is the wage-earner in any other State in the Union, and that the wage-earner of the United States is, in almost every avocation, better paid than is the wage-earner of any other country in the world; while the number of hours that he is required as a rule to render for a day's work is no more in general in California than in other States, and no more in general in the United States than in other countries, with, perhaps, the exception of England, in which the hours of labor per day as shown are not more than nine. Thus, a cabinetmaker in California receives $2.75 for nine hours' work per day; in Indiana, $1.75 for ten hours; in Michigan, $1.92 for nine hours; in Nebraska, $1.75 for ten hours; in North Carolina, $1.13 for ten hours; in New York, $2.50 for nine hours; in Virginia, $1.50 for ten hours; in England, $1.48 for eight and one half hours; in France, $1.40 for ten hours; in Denmark, 80 cents for ten hours; in Austro-Hungary, 47 cents for ——— hours; and in Mexico, $1.25 for ten hours.

A cigarmaker in California receives $2.25 for eight hours' work per day; in Indiana, $1.96 for eight hours; in Michigan, $1.92 for eight hours; in Montana, $3 for eight hours; in Nebraska, $2.21 for eight hours; in North Carolina, $1.27 for eight hours; in New York, $2 for

eight hours; in Virginia, $1.64 for eight and two fifths hours; in Germany, 48 cents for ten hours; in Denmark, 80 cents for ——— hours; in Italy, 60 cents for eleven hours; in Portugal, 92 cents for ——— hours.

In California a carpenter receives $3.50 for eight hours work per day; in Indiana, $2.40 for nine hours; in Michigan, $2 for nine hours; in Montana, $4 for nine hours; in Nebraska, $2.25 for nine hours; in North Carolina, $1.31 for ten hours; in New York, $3.50 for eight hours; in Virginia, $1.56 for ten hours; in England, $1.67 for eight and one third hours; in Germany, $1.44 for ten and one half hours; in France, $1.45 for ten and three fourths hours; in Switzerland, 84 cents for ten hours; in Denmark, $1 for nine and one half hours; in Belgium, 82 cents for eleven hours; in Austro-Hungary, 47 cents for ——— hours; in Sweden, 87 cents for eleven hours; in Italy, 58 cents for ——— hours; in Mexico, 75 cents for ten hours; and in Japan, 24 cents for ——— hours.

In California a cooper receives $2.75 for ten hours' work per day; in Indiana, $1.31 for ten hours; in Michigan, $2.13 for ten hours; in Montana, $3.75 for ten hours; in Nebraska, $2.30 for ten hours; in New York, $3 for ten hours; in Virginia, $1.81 for nine and one half hours; in England, $1.47 for nine hours; in Germany, $1.25 for ten hours; in France, $1.33 for ten and one half hours; in Switzerland, $1.07 for ten hours; in Denmark, 89 cents for ten hours; in Mexico, $1 for ten hours; and in Japan, 19 cents for ——— hours, etc.

The tables show that of the United States which are included therein, wages rule the highest, generally speaking, in California, Montana, and New York, and lowest in Nebraska, North Carolina, and Virginia. Of the foreign countries named, the condition of the wage-earner in the avocations enumerated seems to be best in England (although in the matter of wages alone he in Germany and France comes closely second; in the latter countries, however, he works a greater number of hours per day), and worst in Austro-Hungary, although in Sweden, Belgium, Italy, and Portugal wages seem to be as a rule very low.

Speaking in generalities, North Carolina, Mexico, and France might be brought into one group as regards wages, with the advantage in favor of North Carolina and France.

As noted in another part of this report, persistent effort failed to obtain any reliable data as to present wages in China, and the same is true also of Russia, in both of which countries labor is very cheaply paid.

Japan, as shown by the tables, easily sustains the general belief as to her labor being paid less than that of almost any other country. In connection with this, however, an observation may be made, viz: The popular belief is, that owing to the low wages paid in China and Japan,

the natives of those countries, on reaching America, are naturally willing to work for extremely low wages here, and, by doing so, and being here in large numbers, their competition has forced wages much below normal; and yet, while it is true that they are in California and on the Pacific Coast in large numbers, and surely in many avocations work for less wages than do other classes, labor of all kinds is higher paid in California and on the Pacific Coast, generally speaking, than it is anywhere else in the United States, with the possible exception of Montana, and although Chinese and Japanese labor is almost unknown in such other parts of the Union. This is merely mentioned; explanation is not attempted; but surely it speaks well for our natural advantages when it appears that in spite of all the cheap labor in question, wages are so well maintained in this State.

The lowness of wages in the Southern States, generally speaking, is no doubt due to the presence of so many colored working people, in connection with the fact that there are so few manufacturing enterprises in that portion of the country; the latter is a condition, however, that a few years will no doubt suffice to remedy.

While our statistics as to wages paid in California in 1884 are not voluminous, and the same is true as to wages paid in 1896, yet the following comparison between wages paid in some of the avocations at this time, and those paid in 1884, as shown by the first Biennial Report of this Bureau published at that time, including, in the few cases in which the data are at hand, the wages paid in the same avocations in 1896, may not be uninteresting, viz:

Occupation.	Rate per Day.		
	1884.	1896.	1900.
Bakers	$2 50 to $4 00	$2 50	$2 00
Barbers	----------	2 50	2 00
Blacksmiths	2 50 to 4 00	----------	3 25
Boilermakers	2 00 to 3 00	4 00	3 60
Bookbinders	3 00 to 4 00	----------	3 00
Boxmakers	2 00 to 3 00	----------	1 75
Brass-finishers	2 75 to 5 00	----------	3 50
Brewers	2 50 to 3 50	----------	2 80
Bricklayers	4 00 to 5 00	----------	5 00
Butchers	----------	----------	2 50
Cabinetmakers	3 00 to 4 00	----------	2 75
Canmakers	----------	----------	2 50
Candymakers	1 40	----------	2 50
Carpet-layers	1 75 to 2 50	----------	3 50
Carriage-trimmers	----------	----------	2 75
Cigarmakers	1 25 to 3 00	2 50	2 25
Cigarbox-makers	----------	----------	2 00
Coatmakers	3 25	----------	3 00
Concrete-workers	2 00	2 50	3 00
Conductors, railroad	3 50	----------	3 75
Conductors, street railroad	2 25 to 2 50	----------	2 25
Coopers	2 50 to 3 50	3 75	3 00
Coppersmiths	3 00 to 5 00	----------	3 75
Carpenters	3 00 to 4 00	2 75	3 50
Cutters	----------	----------	3 50

Occupation.	Rate per Day. 1884.	1896.	1900.
Clerks	$2 50 to $6 00	--------	$2 50
Domestics	--------	--------	*18 00
Draughtsmen	--------	--------	4 50
Drapers	--------	--------	3 00
Engineers, railroad	4 50	$4 30	4 30
Engineers, stationary	3 00 to 5 00	--------	2 50
Firemen, railroad	2 50	--------	2 00
Firemen, stationary	2 50 to 3 00	--------	2 00
Gasfitters	3 00 to 4 00	2 70	4 00
Glassblowers	--------	--------	4 50
Glovemakers	2 50 to 4 00	--------	2 50
Grainers	3 50 to 5 00	--------	3 75
Granite-cutters	3 50 to 4 00	--------	3 60
Harnessmakers	2 50 to 3 50	--------	2 25
Hodcarriers	2 50 to 3 00	--------	3 00
Horseshoers	3 50 to 4 00	--------	2 75
Ironworkers	2 50 to 3 50	--------	2 75
Jewelers	4 50	--------	3 50
Laborers	1 75 to 2 00	--------	1 75
Lasters	2 00 to 4 00	--------	1 75
Lathers	2 50 to 3 00	--------	3 00
Laundries	1 50 to 2 00	--------	1 16
'Longshoremen	3 00 to 4 00	3 00	3 60
Machinists	2 50 to 3 50	--------	3 25
Marble-cutters	2 00 to 3 00	--------	3 00
Marble-polishers	2 00 to 2 25	--------	2 00
Marine engineers	2 50 to 5 00	--------	4 50
Milliners	2 30	--------	2 50
Messenger boys	50	--------	1 00
Miners	2 00 to 4 00	2 70	3 00
Molders	3 00 to 4 50	--------	3 25
Painters	3 00 to 4 00	3 00	3 50
Paperhangers	3 50 to 4 00	3 00	3 50
Paperrulers	2 00 to 2 50	--------	3 75
Patternmakers	2 25 to 4 00	3 25	3 50
Planing-mill hands	2 50 to 3 50	--------	2 50
Plasterers	4 00 to 5 00	3 00	4 00
Plumbers	3 00 to 4 00	3 00	4 00
Printers	3 50 to 4 50	--------	3 00
Pressmen	3 00 to 4 00	--------	3 00
Quarrymen	2 00 to 2 50	--------	2 50
Ropemakers	2 00 to 2 50	--------	1 70
Shoemakers	2 00 to 4 00	--------	1 75
Ship captains	3 00 to 7 00	--------	6 00
Ship calkers	3 00 to 5 00	--------	5 00
Ship carpenters	2 00 to 3 00	--------	5 00
Ship joiners	2 00 to 3 00	3 40	4 00
Ship's mates	1 50 to 2 75	--------	2 50
Sailors	75 to 1 00	--------	1 50
Sailmakers	4 00	--------	4 00
Stairbuilders	3 50 to 5 00	2 75	4 00
Stevedores	3 00 to 4 00	2 50	2 70
Street car men	2 00	--------	2 40
Street pavers	2 00 to 5 00	--------	4 00
Teamsters	1 00 to 1 50	--------	2 50
Telegraph operators	1 50 to 2 50	--------	2 00
Tile masons	2 00 to 5 00	--------	3 00
Tobacco-strippers	75 to 2 25	--------	1 00
Trousers-makers	2 50 to 3 50	--------	2 25
Upholsterers	3 00 to 5 00	--------	3 00
Vestmakers	2 50 to 3 50	--------	2 00
Wagonmakers	2 75 to 3 75	--------	2 75
Watchmakers	1 00 to 1 60	--------	3 00
Woodcarvers	2 50 to 4 00	--------	3 50
Woolen-mill hands (male)	2 00 to 3 00	--------	2 00
Woolen-mill hands (female)	1 50 to 1 75	--------	1 25

* Per month.

In the foregoing it will be observed that the data of 1884 simply gave the range within which wages were paid, and there is reason to believe that it includes in the highest rates given the wages of foremen and others holding exceptional positions. In the data of 1900 we have endeavored to give approximately as nearly as possible what the ordinary journeyman worker in the avocation receives, and in doing this we have had to use judgment, considering the State at large, for it will be borne in mind that wages in the same avocation vary considerably in different localities in the State; in the trades being, as a rule, higher in San Francisco than elsewhere, due no doubt to the fact that labor in San Francisco, as noted in another part of this report, is generally better organized than it is in other portions of the State.

The foregoing comparison, as far as it reaches, justifies a conclusion which sets contrary to the general current of belief in such regard, viz: that, taking wages as a whole, they are not materially lower in the State at this time than they were in 1884. It is true that in many avocations wages are less, but, on the other hand, in many avocations they are more, and what is meant is that, as a whole, the equilibrium has been maintained. Thus barbers, bakers, boxmakers, brewers, etc., receive less as a rule, and it is to them but slight consolation to point to the concrete-workers, carpet-layers, gasfitters, and others who receive more, but one seems to balance the other to a great degree.

Another noticeable feature is that the wages of common labor show but little change; they being given by Mr. Enos in 1884 as from $1.75 to $2.00 per day, and that is about the ruling wage at this time, although in some cases of men working with the shovel, etc., in outside places the rate paid is from $1.50 to $1.75 per day.

It is to be regretted that data as to wages paid in 1896 are so meager. The industrial depression which began in 1893 was, in 1896, or along about that period, at about low ebb, and doubtless complete data would show, in many cases, a depression in wages paid during that period; the few instances given, which have been obtained from reports of labor organizations as to increase in wages since 1896, show, in almost every case, the depression named.

Another interesting fact in connection herewith, and in connection with the condition of labor in 1896 as compared with its condition in 1892 and in 1900, is:

During the year 1892 there was deposited in the *savings banks* of California the sum of $95,546,196.13; during the same period there was withdrawn from said banks the sum of $83,304,726.35; there thus being deposited $12,241,469.68 more than was withdrawn.

In 1894, or rather during the year 1894, there was deposited in the said banks $97,496,712 51, and there was withdrawn $104,155,474.06, or $7,658,761.55 in excess of the amount deposited.

In 1899 there was deposited in the said banks $77,572,588.06, and withdrawn $71,867,176.16; there being thus deposited, in excess of the amount withdrawn, $5,705,411.90.

The savings banks of a State or of a nation are the workers' depositories, and by the rise and fall of deposits therein the workers' comparative prosperity can be measured as by a barometer.

The story of a national calamity is told in the showing above, that in the space of two years the tide of the worker's condition had changed to an extent that decreased his earnings in this State almost twenty millions of dollars. An excess of withdrawals over deposits speaks eloquently of employment lost and not regained during long months of idleness and waiting for better things. Fortunately, we can say that the reverse is the condition now.

In connection with this whole subject of the condition of the labor of the State now, as compared with four or five years ago, and in regard to the benefit which labor receives from the generally better condition of industries of every description, it is not uncommon to hear the questions: "Granting that conditions generally are more prosperous, is the individual worker better off? Does he receive more pay? Is the wage rate per diem increased?" To all of which we reply:

The condition from 1894 to 1896 left an enormous percentage of the wage-earners without employment of any kind. Of those who had employment some few escaped reduction of pay. In cases where direct reduction was not made, it was made indirectly in the way of working less than full time. When the tide turned the first result was not of course increase in pay, but absorption of the vast amount of idle labor, and working on full time once more. The next effect was increase in pay in isolated cases, and from that to more frequent cases, until, at this time, demands on the part of labor for more pay and fewer hours of work per day are heard in all directions, with the pleasure of hearing in addition, in most cases, that the demands are granted.

In concluding this article, one more phase of the subject of the present condition of labor in the State should have attention, especially in connection with what has just been said, and that is in relation to increase in cost to him of the necessaries of life, coincident with the increase in prosperity generally as spoken of.

It may be said in general, that the cost of groceries in this State now averages in price about the same as in 1896; some being a little cheaper, and some a little dearer.

Hardware, stoves, and house-furnishing goods are about fifteen per cent higher than in 1896.

Meats are about ten per cent higher.

Drugs and medicines are from five to ten per cent higher.

Clothing is about ten per cent higher.

Dry goods are from five to ten per cent higher.

Fuel: Coal is the same as in 1896; wood is from fifteen to twenty per cent higher.

Rents: As to houses usually occupied by wage-earners, the same, or from five to ten per cent lower. Newer and better classes of houses are some little higher.

From all of the foregoing it would seem that the contention that the condition of the wage-earner in California compares well with the condition of the wage-earner in any other place that can be named, is well sustained, and that in fact California, in this respect, leads the States of the United States, and the United States in turn leads the countries of the world.

SOME OF THE LABOR LAWS OF THE STATE OF CALIFORNIA.

The constitutional provisions and legislative enactments of the State of California, relative to an eight-hour work-day on State and Municipal public work, have, prior to 1899, been little more than mere provisions to the effect that, when agreeable to both parties, eight hours would be regarded as a day's work for men employed. Nothing in them prevented workmen from being required to work as many hours per day as an employer might see fit to require. It is true that, as a rule, those directly in the employ of the State were kept within the spirit of the law; but a great portion of the public work being done by contractors, and the workmen generally being directly employed by such contractors, little heed was given to the eight-hour limit to a day, and workmen worked as many hours as their employer saw fit to impose. In 1899, however, a law was passed which provided, in substance, that no workman, laborer, or mechanic, employed upon the public works of, or work done for, the State of California, or any political subdivision of the same, should be required or permitted to work upon such work more than eight hours in a calendar day; that a stipulation to such effect should be inserted in every contract made by or in behalf of the State for the performance of such work; that a penalty of ten dollars per diem should be withheld from the amount due to any contractor for performing such work, for each workman, laborer, or mechanic who, in his employ, was required or permitted to thus work more than eight hours in one day; and that heavy penalties should be inflicted upon any

officer of the State or of a political subdivision thereof who violated any of the provisions of the law.

Although, so far as I know, this law has not yet been subjected to the test of judicial decision, it would seem to be valid, since it is based upon the same principle that has been upheld, as regards similar legislation, in the Supreme Court of the United States, and in the courts of a number of the States. It having thus been held to be simply in the nature of a rule laid down by an employer, prescribing the terms upon which he will receive persons into his employ, and not a restriction on the private right to contract. In the case of a contractor seeking the work, he is simply required, as one of the conditions upon which he is given the contract, to agree and stipulate (just as he might be required to agree, in the case of a contract let to him by any other builder) that he will not require or permit his workmen to work more than eight hours per day under the contract; and having thus stipulated, he becomes bound, not by any direct mandate of the law, but by his own agreement, to not permit more than eight hours in any day to be worked by his employés in fulfilling his contract.

As said, the law is quite generally observed in cases where the State directly employs. In a few such cases, however, complaint of its non-observance has been made to the Bureau; one notably being that of about two hundred and fifty employés in Golden Gate Park in San Francisco last November, while the government of the Park was yet under the jurisdiction of the State. This complaint I took up with the then Park Commissioners, Messrs. A. B. Spreckels, Wm. H. Metson, and F. W. Zeile, and after somewhat protracted negotiation, in which I was greatly assisted by the advice and encouragement of Governor Henry T. Gage, I, on December 27, 1899, received official notice from the Park Commissioners that the requirement of the law would be complied with, and that thereafter the employés of the Park would be required to work but eight hours per day, instead of nine as theretofore.

Another case was that of some of the employés of the State Belt Railway on the waterfront of San Francisco, who were being required to work twelve hours per day. In this case, however, merely calling the attention of the Board of State Harbor Commissioners to the matter resulted in its immediate correction; and it seemed plain that the violation resulted from an oversight, or from misconstruction of the law, and not from purpose; Mr. Kilburn, chairman of the Board, emphatically saying, that as it was the law to work the employés in question but eight hours, the law should be obeyed.

In cases where the work is done under contract, the violations of the law are much more frequent, and it too often seems to be that those whose duty as State or Municipal officials requires them to enforce obedience to the law, and to inflict penalties, as named, for its non-

observance, are indifferent in the premises, or fail to adopt methods by which they may be made aware of violations when they occur. There is ground given for belief sometimes that the law is not taken seriously, and that it is expected to be more honored in the breach than in the observance. The required stipulation is, as a rule, inserted (although not always); but with that, oftentimes, vigilance seems to end. This is by no means as it should be. It is not enough to say, as is sometimes said, that the law is inexpedient or unwise, or that the men employed are themselves willing to work a longer time. Waiving argument as to the wisdom or otherwise of laws shortening the hours of labor for the worker, the law is upon the books and is a fact. It was desired by workingmen, and was enacted and passed in accordance with their wishes, and presumably for their benefit, and they are as much entitled to its zealous enforcement as is any other class of the community to the enforcement of laws that they deem are beneficial to them. It is not an answer to say that those employed are willing to work a longer time. Such willingness on their part is too often based upon the duress of necessity, faced by the knowledge that lack of such willingness means for them their discharge outright. And again, let us believe that the workers who wished to have the law, and for whose good will it was, perchance, enacted, believed in advocating it, that from it benefit would come to workers as a class, through lessening the number of hours per day of the individual, and thereby increasing the number of individuals employed; and this being the case, and the law being given them, they are entitled to the expected benefit as a class, or as a body, even though individuals among them may be found who, through duress, as named, or through hope of earnings in the way of overtime, are willing in their individual cases to have the law ignored.

One instance which was complained of to me was of contract work upon a county road. The Special Agent of the Bureau investigated, and made positive report that the law was being violated, and that the men in question were being required to work ten hours per day. The attention of the Board of Supervisors of the county was called to the circumstances, with only the result, however, that after much delay reply was given that they had investigated and found no violation of the law. It will be noted in connection with this law that in case of a violation by a contractor of his stipulation, as required by the law, the question of whether there has been violation and the matter of the enforcement of the penalty are almost exclusively within the discretion and control of the Board of Supervisors, or other municipal authority which has control of the letting of the contract. In the case just before cited, it was reported to me that one of the members of the Board of Supervisors which had control of the letting of the work in question, lived almost in sight of where the work was being done, in

the doing of which the alleged violation of the stipulation was taking place.

Another complaint was made to me of a case of a contract let for work which was within the contemplation of this law, from which the said stipulation required by the law to be inserted therein was entirely omitted. This is something that rarely has happened, but it raises an interesting question, for in such a case a contractor, working the men employed upon the work more than eight hours per day, is entirely beyond the reach of the law. The penalty of the law cannot reach him, for he made no stipulation as to the number of hours per day his employés should work. It has been held in the courts that the omission of the stipulation does not invalidate his contract, and he is entirely secure under it; hence, there only remains the question, whether or not the municipal authority, which should by direction of the law have required and caused the contract to contain the stipulation, can be punished for its breach of duty. I am not aware that this question has ever received judicial reply as regards this law. Section 3 of the law provides a penalty of fine and imprisonment for any officer of the State, or of a political subdivision thereof, who violates any of the provisions of the Act in question, and it has been my intent as soon as time permits to take the question up in connection with the case in point, with view to obtaining, if possible, a judicial decision as to liability on the part of the officials named for failure to place the stipulation in question in contracts which are within the purview of the law. In any event, an amendment to the law might be advisable which would clearly indicate those upon whom it intends responsibility to rest for omission to insert the required stipulation, and the penalty to be imposed upon them in case of such omission.

In addition to the State eight-hour law in question, the Federal eight-hour law applies in California to all laborers, workmen, and mechanics employed upon the public works of the United States. This law, in its present form, differs from the State law, in that, whereas the State law simply binds the contractor for the work, by his own agreement, voluntarily made when he accepts the contract, to refrain from requiring or permitting his employés upon such work to labor more than eight hours in one day, and simply makes him liable (again by his own agreement) to loss of money due to him under the contract at the rate of ten dollars per day for each such violation (the case of each workman being considered a separate violation in such regard), the Federal law makes such required or permitted violation a penal offense, punishable by fine and imprisonment. This law, like the before-named State law, is well observed as a rule wherever the worker is in the direct employ of the Federal Government; but it is often overlooked when such work is done by contract. And here again a difference exists between the State law

and the Federal law in cases of violation, in that, in the first as shown, the State or Municipal officials under whose authority the work is done are required to inform themselves of, and to take cognizance of, such violations, while in the case of Federal work the officials letting the contract are under no such a responsibility, and it rests with any one who is cognizant of the violation, and who may see fit to do so, to make complaint of the infringement of the law.

The assistance of the Bureau has been invoked on one or two occasions where this Federal law was not being properly observed; notably in the case of work being done for the United States Government by contractors on what is named as the "Tidal Canal," and also on "Sausal" Creek, in Alameda County in this State. Three several contractors were engaged on the different parts of the said work, and all were disregarding the law. I caused the matter to be carefully investigated, acting in conjunction with Mr. Mullen, Business Agent of the Alameda County Building Trades' Council, in so doing, with the result that conclusive evidence of the violation of the law was secured; whereupon one of the contractors in question immediately changed his policy, and thereafter complied with the law; which being the end desired, caused further action against him to be held in abeyance. In the case of the other two, warrants for their arrest were sworn out under the direction of Mr. Mullen and myself. In due time one was arrested, and, on preliminary hearing before the Commissioner of the United States District Court, was held for trial. A short time later the other one was likewise arrested, but expressed a willingness to plead guilty, explaining that the violation of the law had been without his knowledge, and at once changed the working hours of his employés on the work to the requisite eight hours per day. Both of these latter named cases are, at this writing, still pending in the United States Court, awaiting final hearing and disposition. The contractor named as having been held for trial has indicated an intention to test the validity or constitutionality of the law by appeal to higher courts in case the judgment be against him in the District Court. In regard thereto it may be said that it is believed that the issue of law thus involved, viz: "whether Congress may validly pass laws which regulate the number of hours per day that the employés of a contractor, doing work under contract for the Federal Government, may work, and make the violation of such laws a penal offense," has never been decided as yet by the Supreme Court of the United States, although one or two cases involving the said issue are said to be pending in that court.

Recently in Congress a bill was introduced seeking to enact a Federal eight-hour law in all essential respects the same as the present eight-hour law of California, just before described. The said bill passed the House of Representatives, but has not yet passed the Senate, and hence

the question of its ultimate disposition remains undecided. Properly enforced, it would no doubt be more effective than the present Federal eight-hour law.

The remarks made herein in connection with the California law relative to the justice of properly enforcing the same, apply with equal force in the matter of enforcing the Federal law; and it is believed that the public generally should earnestly advocate that the worker, who by reason of his necessities is often unable to take his own part, or to resent infringements upon his rights in this regard, be accorded the benefits which the law intends shall be his by its provisions, and that those charged with the duty of prosecuting and punishing violations of the law should in no case be lax in action because he who may be benefited by the zealous enforcement of the law is poor.

LAW RELATIVE TO INJURIOUS INHALATIONS.

In Section 4 of Chapter V, California Statutes of 1889, page 3, it is provided that: "If in any factory or workshop any process or work is carried on by which dust, filaments, or injurious gases are generated or produced that are liable to be inhaled by the persons employed therein, and it appears to the Commissioner of the Bureau of Labor Statistics that such inhalation could, to a great extent, be prevented by the use of some mechanical contrivance, he shall direct that such contrivance shall be provided, and within a reasonable time it shall be so provided and used."

Section 6 of the same Act provides that: "Any person or corporation violating any of the provisions of this Act shall be punished by a fine of not less than fifty nor more than one hundred dollars for each offense."

While this law has been in existence in this State since 1889, the enforcement of it heretofore seems not to have received any attention. About July of the present year (1900) my attention was called to the condition of the employés in some of the metal-polishing establishments in the City of San Francisco. I at once took the matter up and made a careful personal investigation of the said establishments, and as a result found that in some of them the atmosphere in which the employés worked was continually poisoned and rendered unhealthful by reason of the filings and dust thrown off from the grinding and buffing wheels while grinding and polishing was being carried on, and that the employés were forced, while at work, to inhale said dust and filaments in large quantities, much to their discomfort and injury. It further appeared to me that the use of a suction-blower in such establishments, with proper attachments, would in most cases prevent the said inhalation and consequent injury, and I therefore, during the early part of August of this year (1900), ordered the placing of such suction-blowers, with their proper incidental attachments, in seven of the said metal-polishing

establishments, naming in each case thirty days from and after the date of the giving of the order as the limit within which its provisions should be complied with.

At this writing one of the establishments, in cheerful compliance with the order, has the blower in operation, with most satisfactory results. Some of the others have asked for extension of time within which to comply with the order, giving seemingly good reasons for asking for such extension, and in all such cases a reasonable extension of the time has been granted. Still others have made no response whatever, and seemingly have taken no steps to obey the order, and in these cases legal steps will be taken, if necessary, to enforce compliance within due time after the expiration of the limit named in the order.

In a number of other instances of a minor nature the assistance of the Bureau has been given toward causing the observance of laws enacted for the benefit of the labor of the State, and such assistance will always be willingly and zealously given in the future, to the same end, in every case which comes to the notice of the Bureau, and in which it has authority, or has ground upon which to act.

UNFAIR PRACTICES UNDER THE "MONTHLY PAY-DAY LAW."

In the past much complaint has been made from time to time regarding payment, by certain employers, of the wages of their employés; it having been a common practice on the part of some to avoid payment of such wages in coin altogether, and in lieu thereof to maintain a "store," at which the employé might buy from the employer such articles as he might choose, and be charged exorbitant prices for the same. In some cases such a thing as payment of wages in coin would be unheard of for months at a time; and it at times happened, too, that while owing large sums in accumulated wages to its employés, a concern would fail, with result that its said employés would lose their earnings.

It was with the hope of correcting in great degree this evil, that the Legislature of California, in 1897, passed the "monthly pay-day law" (Stats. Cal. 1897, p. 231), which requires every corporation doing business in this State to pay its employés at least once a month, and, so doing, to pay on the day of payment all wages earned by such employés during the month next prior to the month in which such payment is made.

This law, while working undoubted benefit at times in one direction, has been made by some employers the basis of what would seem to be great unfairness to wage-earners in another direction or way, viz: What is termed a "monthly pay-day" is established under the law, such pay-day usually being about the 25th day of the month; and on such pay-day there being due and payable all wages earned during the preceding

month. On the first day of July a worker enters the service of the employer, usually through the medium of some employment agency. There may be posted somewhere about the work, often in an obscure place, a notice to employés, stating that the "pay-day" is on the 25th day of each month. This notice the employé perhaps never sees or hears of during his term of service. Whether he does or not is of little moment, since the duress of his necessity often leaves him but little latitude for independence in arranging the terms of his employment. He continues in the service for ten days, say, or until the 10th of July, and then is discharged, or perhaps quits, as he has a right to do. His reasons for quitting may at times be but poor ones; but, again, they may be of the best. He may fall sick; he may be summoned to the distant bedside of a dying relative; he may see opportunity to better his condition by going elsewhere; but all this is not very material. As said, he is discharged, or he quits, on the 10th day of July, and receives from his foreman a "time-check," which certifies that "John Smith has worked ten days (from July 1st to July 10th), for 'The Wage-Earners' Benefit Association' (a corporation), at $1.75 per day," and proceeds to state as follows, viz:

Amount earned		$17 50
Deduction for board (corporation boarding-house)	$7 00	
Deduction for merchandise (corporation store)	2 00	
Deduction for medical fee (corporation doctor)	50	
		9 50
Balance due		$8 00

This time-check is not transferable, and if presented by any person other than the one to whom issued, payment will be refused. Payment of the amount of balance due, as shown by this check, will be made only upon the regular pay-day of the month following the month during which the service as herein shown was performed.

Hence, by all the foregoing, John Smith often stands, upon the 10th day of July, with his time-check in his hand, the $8 balance due, as shown thereon, representing his entire worldly assets aside from the clothes he wears, without the means wherewith to obtain a meal, under the necessity perhaps, as shown above, of going without delay to some distant place, and with the information facing him, from the check itself, that it is non-negotiable, and that his ex-employer will not pay him the balance shown due until the 25th day of the following month, or at a time about six weeks later. In his perplexity and need he finally finds his way to his former employer and asks if he cannot be paid his money forthwith, usually to be met with the reply that his check is made out according to the law, and according to the rules of the corporation, and that no exception can be made in his case. However (after some hesitation, during which John Smith has had ample oppor-

tunity to realize the helplessness of his situation), he is often informed that if he is really in need of the money, the corporation, as an accommodation to him, will advance him the balance due, forthwith, at a discount of ten per cent.

The money is at the time absolutely his. There is no moral or legal reason why it should not be paid to him without delay, and yet, in order to obtain it, he is forced to pay to the one who owes it to him, ten cents on each dollar of it.

This method is frequently in vogue on work that is being done by contractors who employ large numbers of common laborers. Upon such work, as is well known, many laborers come and go from month to month. Take the case of work where, say, five hundred men are employed; the personnel of such a force will change to the extent perhaps of one half each month, from which it plainly appears that the profit to the employer accruing from the discount of balances due as named is considerable.

In some cases where investigation has been made of complaints of evils of the foregoing nature, it has been said that such practices are made necessary by reason of the instability of the workers in the matter of working for but short periods of time and then quitting and going away, with resulting inconvenience to the employer. There are two strong objections to this defense; that is to say:

(1) These men are simply employed by the day, with no promise of employment for any definite time, and under the law they are free to quit the employment at the end of any day, and any practice designed to restrict their exercise of that freedom, or to coerce them to remain when they desire to go, is an infringement of their liberty.

(2) It will be seen that under the said practice a man who has once begun service can in no way and at no time terminate that service without being put to the inconvenience of waiting, as described, for some part of the wages he has earned, or else yielding a portion of them in order to receive the remainder without delay.

These practices do not prevail with large corporations and with those of good standing, as a rule. The large railroad and transportation companies, and those of similar kind, have no such rules or methods; it remains for the smaller corporations and contractors to adopt them.

It is a subject which should have legislative attention, and if possible some amendment should be made to the law as it is, or some new law should be enacted, which will prohibit such practices altogether.

In the article in this report relative to women wage-earners in California, brief mention is made, as regards women, of another evil to which the workers are subject, and that is the loss, in more or less amount, of wages earned and due.

Complaints in this regard come not alone from women, but from all classes of wage-earners, indiscriminately, several hundred of such cases

having been thus brought to my notice since my connection with the Bureau, involving amounts aggregating many hundreds of dollars. In a few cases such claims have been unfounded, or have been prematurely brought, but in the great majority of them they have been just. In a few cases, too, the neglect of the employer to pay has arisen from honest inability to pay immediately, and in all such cases a harmonious adjustment has been easily reached. In some of the cases the refusal to pay seems to have been based simply on a feeling on the part of the employer that he has not been treated well by the employé, and that therefore he will put the employé to all the delay and trouble he can before making settlement. But, all such cases as before named aside, a great number remain in which there seems a deliberate purpose to avoid the payment of a just wage debt.

Often the claimant has nothing in the world save the small amount due. He or she cannot remain and wait, but must be up and moving in search of other employment. The court is open if it is desired to bring suit, for even without money the claimant can, so far as court costs are concerned, have his cause heard, upon making proper showing that he is without means. But, in order to effectively reach court at all he must have the help of an attorney, and in most cases the retainer required by the attorney would come to more than the amount of the claim. Again: After suit is filed there is delay of days, perhaps weeks, before judgment is finally rendered. And even then, at the end of all, with judgment in his possession, the claimant will often find that his ex-employer is without property or other assets of any kind, and that hence his judgment must remain unsatisfied. When we reflect that of the whole number of such cases, scarcely any, comparatively, find their way to the Bureau, or to the public eye, the magnitude of this evil is apparent.

Of the cases which have been brought to the Bureau, all those found to possess merit have been taken up earnestly, and zealous effort made to effect settlements; often, it is gratifying to say, with success; and in this way a great deal of good is done; but, as noted elsewhere, the whole subject is one which should have careful attention from our legislators, and it is a matter, too, where public opinion might give powerful aid to the helpless workers if the public would but remain more alive to these injustices, and more zealous than is the rule when such cases are brought to light.

EMPLOYMENT AGENCIES.

There exists at all times complaint, more or less, relative to impositions to which persons are subjected who seek the assistance of employment agencies in endeavors to secure work. Wrongs most frequently complained of are:

(1) The exaction of exorbitant employment agency fees.

As to this, I have to say, that cases have come to my notice wherein the agency, while entirely within its legal rights, has, it has seemed to me, exacted much more than it gave value for.

(2) The sending of applicants for work to positions which did not exist, or which were filled prior to the arrival of the person sent as named.

As to this, a number of such cases have come to my notice. In some of them the fault has been with the agency, in "neglecting" (to say the least) to be sure, before collecting the fee and directing the applicant, that the position was really available.

(3) Applicants for work sent, after collection of fee, to positions, while a secret understanding existed between the agent and the employer that the person sent would soon be discharged on some pretext or other, to make room for another, to be sent in the same way, and so on, thus enabling agent and employer to divide the fees obtained.

As to this, I have to say that no case has come to my notice wherein such complaint has béen sustained. Naturally, proof of such a scheme would be difficult in any case, even if the scheme were being carried on. Falling off of work, or some equally plausible reason, can always be advanced as ground for discharge; hence, as the evidence before me stands, I can neither affirm, nor yet deny, as to the soundness of such complaint.

(4) Refusal to return fees when positions promised, or directed to, are not secured.

As to this, complaints have been quite frequent; sometimes well founded, but not always so.

(5) Fraudulent institutions, masquerading as employment agencies.

As to which, several such institutions have come to my notice. One purported to be a "Free Employment Agency," maintained by certain parties in San Francisco, who solicited donations from charitably inclined persons, representing the while that the institution was maintained

for the benefit of the poor unemployed. Investigation demonstrated that the office of the affair was adjacent to a saloon, and was connected therewith by an open door; that donations received averaged from $80 to $100 per month; that not one case of employment obtained by the institution for any person within several months prior to the date of the investigation could be established, or verified, although its president was earnest in claiming that it was what it represented itself to be, and stated that it had been maintained for several years, and even produced a certificate of its good standing, signed by a former Commissioner of this Bureau. I was forced, on the showing made, to regard it as fraudulent, and the exposé made regarding it was soon followed by its demise.

The "Commercial Clerks' Information Bureau," conducted by a Mr. S. Morris, and at present located in room 81 of the Flood building, San Francisco, received extended notice from my predecessor, on page 67 of the Report of this Bureau covering the years 1895–96. The said institution pays a license as a regular employment agency. It registers all applicants for employment, requiring them to pay a "registration" fee of $1 for the privilege of being thus registered. The applicant is then told to depart, and wait until sent for to take a position. If no position is secured, the $1 fee is nevertheless retained. All this is contrary to the license ordinance of the City and County of San Francisco, which provides, in substance, that all money paid for assistance to obtain employment shall be returned to the party paying the same in case a position be not secured, and makes the revocation of license the penalty for failure on the part of an employment agent to observe its provisions. A specific charge of this kind being brought against the said "Commercial Clerks' Information Bureau," a careful investigation of its methods was made, and its proprietor, Mr. Morris, defiantly refusing to discontinue illegally charging a "registration" fee, as named, complaint against him was filed with the Board of Supervisors of the City and County of San Francisco, and revocation of his license was requested. After some weeks' delay the matter came to a hearing before the board, which later served upon Mr. Morris an order, directing him either to conform thereafter to the requirements of the ordinance above named, or suffer the loss of his license as an employment agent. While there has since been no specific charge made in this Bureau against him, I have reason to believe that he continues to exact a "registration" fee, as described; in some cases at least. However, the delay and difficulty experienced in prosecuting the former charge against him has caused me to feel that the State should have more direct and summary methods by which to deal with such cases.

In March, 1900, the "Business Women's Club," duly incorporated under the laws of the State of California, opened offices at No. 927

Market Street, San Francisco, as a duly licensed, high-class employment agency, and by enticingly worded advertisements brought people, in most cases young men and women, to the presence of its president and manager, Mrs. Bradley. Once there they were, if of seeming promise in the way of cash, informed that a responsible position, with good salary, was open in the offices of the club itself, which position they seemed in every way peculiarly well qualified to fill, but that the rules of the corporation inflexibly required all its employés to be stockholders, as a surety of good faith and zeal on their part in the discharge of their duties, and they were thereupon urged to buy stock and accept the situation. The institution was conducted in this way for several months, during which time its business as an employment agency was nominal, but its manager succeeded in collecting some $800 or $900, in sums ranging from $5 to $200, for stock sold to various persons in the way described. Finally, the matter having been brought to my notice, an investigation was immediately made, which showed that the promised salaries were all unpaid, and that all money was in the hands of the manager, Mrs. Bradley. Her arrest for embezzlement was caused. She was held for trial before the Superior Court in $500 cash bail, which she caused to be deposited, and thus gaining freedom, fled from the State.

Thus viewing the summarized grounds of complaint against employment agencies, it must not be believed that the employment agent does not make his complaint at times as well. He tells, upon occasion, of utter unreliability and instability on the part of professed seekers for employment; of those sent in good faith to fill orders, who break engagements and refuse or fail to go, much to the injury of the business of the agent, and to the inconvenience and detriment of the waiting would-be employer; and he suggests that, while considering remedies for evils in connection with this whole subject, it might not be out of place to consider means wherewith to mitigate the wrongs and ills inflicted upon employers, upon employment agents, and upon honest labor itself, within the State, by unreliable and undeserving (professed to be) workers themselves. All these things foregoing have caused me to give some thought to this subject, and to the question of remedies possible to be devised and applied, which would tend to mitigate or suppress the evils enumerated.

Conducting an employment agency is a legitimate business under the law, and is one which, when honestly carried on, serves in more or less degree a beneficial purpose in the industrial economy of a State. It is not the agency itself, but fraud and imposition sometimes practiced in connection with it, which in any case makes it an evil. If its proprietor be honest there will be little ground for complaint; if he be dishonest, humanity will suffer in dealing with him, the same as it will in dealing with him in any other way; hence, it is seen that the proposition,

sometimes advanced, that all employment agencies should be suppressed, is not well established; but the dishonest ones among them, and the dishonest practices in connection with some of them, should be suppressed.

Passing, we may inquire as to what workers, as a rule, seek the assistance of employment agencies, and in this regard it may be said that, as a rule, they are the workers who follow unskilled avocations. Those in skilled trades, and particularly those who are members of labor organizations, seldom, under ordinary conditions, seek employment through the medium of employment agencies; although unusual conditions may cause departure from this rule at times.

In this connection the following lists (by avocations) of applications for employment, made to employment agencies within given periods, may be instructive:

APPLICATIONS TO EMPLOYMENT AGENCIES.

Males.

Avocation.	No.	Avocation.	No.
Barn man	9	Janitor	1
Bartender	1	Laborer	72
Boy	5	Machinist	1
Carpenter	2	Machine hand	1
Clerk, general	9	Polisher	2
Cook	4	Pressman	1
Dishwasher	11	Porter	10
Electrician	1	Salesman	1
Farm hand	21	Teamster	2
Fireman	3	Waiter	3
House man	11	Watchman	5

Females.

Avocation.	No.	Avocation.	No.
Bookkeeper	1	Laundress	6
Chambermaid	10	Nurse	4
Cook	19	Office work	4
Day work	2	Pantry work	4
Dishwasher	10	Scrub woman	20
Factory work	3	Seamstress	3
Housekeeper	1	Second girl	5
House work	79	Stenographer	2
Kitchen work	13	Waitress	19

And again:

Males.

Avocation.	No.	Avocation.	No.
Arts	29	Ironworker	7
About house	2	Janitor	98
Boilermaker	2	Kitchen help	159
Bartender	112	Laborer	3,498
Baker	170	Lumberman	30
Barber	10	Laundryman	60
Bookbinder	12	Liveryman	14
Blacksmith	261	Machinist	237
Brewer	9	Mason	113
Boy	364	Miller	7
Butcher	108	Miner	178
Bookkeeper	254	Man and wife	49
Candymaker	8	Miscellaneous	487
Carpenter	585	Nurse	33
Clerk	799	Plasterer	6
Coachman	121	Painter	241
Cook	727	Paperhanger	59
Cigarmaker	11	Peddler	19
Cooper	26	Plumber	105
Dairyman	104	Porter	423
Dentist	1	Printer	64
Druggist	11	Salesman	185
Dishwasher	89	Shoemaker	41
Electrician	47	Stenographer	44
Engineer	502	Stone-cutter	39
Fireman	20	Tailor	10
Factory	21	Teacher	20
Farmer	548	Teamster	885
Fruit	321	Tinsmith	21
Gardener	176	Upholsterer	3
Handyman	238	Waiter	323
Harnessmaker	30	Watchman	179
Hotel help	155	Woodman	250
Hostler	138	Wagon-driver	42
Hop-picker	311		

Females.

Avocation.	No.	Avocation.	No.
Arts	8	Hop-picker	185
Bookkeeper	28	Laundress	96
Chamber work	611	Milliner	25
Clerk	150	Miscellaneous	46
Cigarmaker	3	Nurse	302
Cook	415	Raisin-packer	96
Cannery help	294	Seamstress	107
Factory help	36	Stenographer	49
Governess	141	Teacher	38
Housekeeper	189	Waitress	217
Housework	1,633		

Another feature, interesting in connection with a close study of this subject, is the approximate average length of time for which a situation, obtained through the medium of an employment office, is held by the person who secures it. While it is true that in many cases places thus obtained are held for years, those conversant with the subject estimate that, as a rule, such situations are held on an average but about two months. This may suggest that labor of the kind here in question is unstable; which is to some extent true, no doubt; but therewith must be borne in mind the fact that much of the work which such labor does is itself unstable, or of but temporary duration.

Again, as to the percentage of the wage-earners of the State who are habitual patrons of employment agencies. Little in the way of reliable data is at hand. Reflection shows, however, that it is small in comparison with the entire wage-earning population—approximately, probably, not more than ten per cent. Herewith, however, must be borne in mind again the fact that, as said above, the average of time during which positions secured through the medium of employment agencies are held is but about two months, and hence it is manifest that the same person has, on an average, in the course of a year, made repeated applications, and that therefore the aggregate number of applications made becomes very large.

While, unfortunately, we have no up-to-date data as to the number of employment agencies in the State, my predecessor, the Hon. E. L. Fitzgerald, reported about seventy regular agencies existing in the year 1896, aside from a greater or less number of such agencies carried on in conjunction with other kinds of business, and it is probable that the number remains about the same at this time.

With all the foregoing as premise, and it being shown, it is assumed, that some remedy should be applied which will mitigate or suppress, as named, the evils complained of, question comes as to what shall be that remedy?

The maintenance, by the State, of "Free Employment Agencies" is advocated by some as furnishing such remedy, and such agencies have been established in a number of the United States and in some foreign countries. The States referred to include Ohio, Montana, Nebraska, New York, Illinois, Missouri, Washington, and California, and the foreign countries include France, England, Germany, New Zealand, Australia, Bavaria, and Russia. It must not be supposed that in all of the States and countries named a system of such "free agencies" has been maintained complete enough to cover all territory in all cases. As a rule, but a small territory has been reached. The "free agencies" established as named in Missouri, Washington, and California, were instituted and carried on by the Bureaus of Labor Statistics of the said respective States, without any special legislative authorization. The one in California was maintained between July, 1895, and June, 1897, by my predecessor, the Hon. E. L. Fitzgerald, and was supported during its existence out of the ordinary contingent fund of the Bureau, aided to some extent by private contribution. At the session of the Legislature of 1897 a bill was introduced providing for the establishment and maintenance, under the supervision of the Bureau, of such "free agencies" at various points throughout the State, but the bill failed to become a law.

While, as said, this plan of maintaining free State employment agencies is advocated by some as a proper remedy, the question of its

feasibility and expediency will bear analysis; and here we may step aside for a moment to note a possibly somewhat popularly prevailing belief, based upon superficial thought, viz: that, somehow, "Free Employment Agencies" make work in the aggregate more plentiful, and wages better. As a fact, such agencies make neither more, nor yet less, the volume of work to be done. When industries are depressed, applications for places will be many, while places secured will be but few. Thus, the report of former Commissioner Fitzgerald, relative to the Free Employment Agency maintained by him in this State, as heretofore said, shows that while, during the time between July, 1895, and July, 1896, 18,920 persons applied to the agency for employment, only 5,845, or but about thirty-one per cent, secured places. In times of industrial activity, the reverse of the proposition is presented, viz: that the orders from employers for help greatly exceed in number the applicants for positions. It is thus plain that the benefit arising from the maintenance of "Free Employment Agencies" will exhaust itself in one or both of two ways, that is to say:

(1) By protecting wage-earners from purporting-to-be agencies that are merely swindles, and by protecting them from imposition in the way of exorbitant charges for fees, and refusals to return fees when places promised are not secured.

As to this, it is manifest that the wage-earner is entitled to the protection named, as far as society and the law can within reason give it. Those who seek assistance from employment agencies in endeavoring to secure employment are, as a rule, poor, and, under the duress of their condition, are peculiarly liable to imposition. When imposed upon they are to a great extent helpless in the matter of obtaining redress, and these things commend them to the legislative authority as entitled to protection. It matters not that some of them may be unstable and improvident, or that their number, in comparison with the entire working population of the State, may be small; such things make only additional reason why appropriate action should be taken in their behalf. But the question remains, "Will the maintenance of 'Free Employment Agencies' by the State be feasible and expedient in the way of the remedy sought?" Those not friendly to the maintenance of such agencies suggest several objections to them, as for instance: "That the applicant for employment, paying no fee, and being in no way liable to pecuniary loss in so doing, would be entirely careless in the matter of keeping engagements when sent to fill orders for help, and that thus employers, finding the agency entirely unreliable as to filling orders, would not patronize it, but would continue to place their orders for help with the regular agencies, thus forcing the worker still to patronize such agencies in most part."

Again: "That being 'free,' such agency would, as 'free' things usually

do, attract in most part the shiftless and unreliable, rather than the thrifty and reliable, among the workers, much to the detriment of the success of the agency."

And still again: "That being 'free,' the agency would in time of industrial depression attract indigent labor from elsewhere, to compete with the workers of the State for what little there might be in the way of employment."

Once more: "That its managers, in no way dependent upon success for income, would lack zeal in conducting it," etc.

I voice these objections for what they may severally seem worth. Doubtless there is merit in some of them. A law prohibiting the maintenance of private agencies, or prohibiting employers from patronizing such agencies, would seem scarcely practicable, and yet, manifestly, with the private agency still permitted, and the employer still free to place his order for labor with it, the "free agency" as a medium through which to secure help must be in all ways as reliable and as desirable as the private agency in order to receive patronage at all from employers. If the "free agency" was not patronized, and the private agency still flourished, plainly the "free agency" would be useless as a remedy for the evils of the private agency.

But another consideration presents itself. Wage-earners cannot ordinarily travel long distances in order to seek assistance from an employment agency. The agency maintained in this State in 1895–6–7, as said, located in San Francisco, and doubtless, under the circumstances, of local benefit to labor, was not available to the workers of other parts of the State, and it is apparent that to equally benefit the various localities (and the State managing it, all should have equal benefit) there must necessarily be numerous "free employment" offices distributed in proper places; whereupon would arise the question of great cost for maintenance, coupled with consideration of the fact that, as before mentioned, in times of either great industrial depression or industrial activity, the agency, while receiving many applications for places, or for help, as the case might be, would be able to afford relief, or fill positions, in comparatively but few cases. This question of cost to the taxpayers enters largely into consideration of the feasibility of the plan. Plainly, to make the benefit general and equally accessible throughout the State would require a large annual expenditure, and this, with the other considerations connected with this phase of the whole subject, is now left to the judgment of the various readers of this report.

(2) The second way, as before named, in which benefit arising from the maintenance of "Free Employment Agencies" must perforce exhaust itself, is by causing the State to bear the burden in the way of fees paid by wage-earners to employment agencies, which the wage-earners now bear. Stripped to its ultimate effect this would be a species of "State

aid." Calling attention to those things before mentioned, which, by causing the "free agency" to be not patronized, would neutralize its utility as a remedy for the evils herein named, as well as its benefit in this immediate regard, and to the fact that the cost of maintenance must equally, through good or evil times, go on, there is no doubt but that there are times during which it is desirable for the State, or for any other agency able to do so, to bear the said burden in behalf of many honest and deserving workers. In times of great industrial depression, such as existed during the time before named, when a "Free Employment Agency" was maintained, as described, in connection with this Bureau in the city of San Francisco, anything which lightens the burden of the worker in his endeavor to secure employment is desirable; whether it be the bearing of the burden of the employment agency fee, or of the railway or other transportation fare necessary to enable him to reach places where work can be had. Not the least among the benefits mentioned by Commissioner Fitzgerald as having arisen from the work of the "Free Employment Agency," was its ability to secure from the Southern Pacific Company reduced railway transportation for persons seeking employment, aggregating in amount over $1,900. Indeed, in many cases mere lack of the requisite employment agency fee is the least evil which confronts the idle worker. The lack of fare for transportation is oftentimes more serious, and the failure of employment everywhere is most serious of all; and so, as said, in such evil times, the State, or any other agency, may well and fittingly do all reasonably possible to lighten these several burdens of the deserving unemployed. But, considering the "Free Employment Agency" as a medium through which to work in such cases, and its expediency as such medium, heed should be given to the fact, as just before named, that while cost of maintenance goes on through good as well as evil times, the necessity for aid of the kind described, in great measure, vanishes when the good times come; and all this suggests the question whether there be not some other method by which the evils complained of (as named) in connection with employment agencies, can be suppressed or mitigated more effectually, possibly (and involving less cost to the State) than by the operation of the "Free Employment Agency."

In other things the legislative power has been often invoked to provide protection to the people against fraud and imposition; and this has been particularly the case in things wherein the duress of necessity is peculiarly liable to allow the poor and the helpless to be taken advantage of, and in things wherein the relative situations of parties in their mutual dealings place one at a disadvantage as against the other. Thus, the banks of the State, and the building and loan associations, are all under the control and supervision of commissions, whose duty it is to require

such institutions to deal honestly in all things with their patrons, and to suspend the operations of such institutions when derelict in such regard. The law is heard to say again that those who carry on the business of a pawnbroker shall not be free to take unlimited advantage of the necessities, and of the oftentimes helpless condition, of the persons with whom they deal. I can imagine no one more entitled to protection from imposition than the person out of work, honestly seeking employment, going with perhaps his last coin to the employment agency, to seek assistance in his search, and yet as it now is we find that the law affords such person scarcely any protection at all. So far as general legislation in this regard is concerned, it has expended itself at this time in Subdivision 25 of Section 25 of the County Government Act of 1897 (Stats. of Cal. 1897, p. 452), which simply delegates to the Supervisors of the several counties authority to license employment agencies.

In the City and County of San Francisco, the Board of Supervisors some years since passed an ordinance (which is still in force) providing, in substance, that each keeper of an intelligence office shall pay a license tax of $16 per quarter, and shall, for all money received for assistance in obtaining employment, give to the payor a receipt, conditioned that if the promised place be not secured by the applicant, the money paid will be refunded if the receipt be returned within two days (or ten days if the promised position be outside of the City and County of San Francisco), together with a written statement from the prospective employer that the applicant could not get the situation promised.

Under this meager legislative supervision licenses are at times issued to institutions which are simply fraudulent. With license once obtained, the keeper of the intelligence office is left to his own will and devices; no one is clothed with special authority to inquire into or supervise his methods; if he be dishonest his victims can of course complain to the Police Courts of having been swindled, but in most cases the sum involved is but a dollar or two (large, oftentimes, to the victim, it is true); the complainant, out of work, without means, probably without witnesses, unable to wait for the law's delay, must move on to live, and so in most cases must helplessly submit. If they come to this Bureau with complaint, it can only directly use moral suasion with the offending agency; if necessary to go further it must work through the courts, or through the Board of Supervisors, as instanced in a case described herein, and thus the complainant must be under the same disadvantage as to delay, which was just named, and the Bureau perforce soon finds itself with its prosecuting witness gone.

With the foregoing presentation of this whole subject, I take the liberty of presenting, for consideration, to the people of the State, and to its Legislature, the question of the expediency and feasibility, as remedies of the kind desired, of legislative enactments as follows:

(1) Prohibiting the collection of an employment agency fee in any case prior to the time when information of a situation such as sought for, and actually then open to the applicant, is given to the applicant.

(2) Requiring prompt return of the fee to the payor, in all cases wherein the position for which payment was made is, through no fault of the applicant, not open to him as understood when fee was paid.

(3) Making employment agents responsible for reasonable costs and expenses incurred in going to and returning from place to which directed, by applicants paying fees as herein, in all cases wherein the place to which directed shall be, in any material respect, other than as represented when fee was paid, and in all cases wherein places are not open, as next above, through no fault of the applicant.

(4) Prescribing the maximum fee which an employment agent may charge in any case for assistance in securing employment for any person.

(5) Placing all employment agencies in the State under the supervision of the State Bureau of Labor Statistics; requiring county officials to report to said Bureau the names and addresses of all corporations, companies, and persons to whom licenses to maintain intelligence offices within their respective counties are issued; investing the said Bureau with authority to hear and determine regarding complaints against such agencies, and to suspend or revoke the licenses of such agencies upon proper cause shown; also, requiring such agencies, at stated periods, to furnish to the said Bureau, in manner and form such as may be prescribed by the Bureau, reports, showing, in substance, applications for employment, kinds of work applied for, applications for help, kinds of help applied for, places furnished, fees collected, fees returned, demands for return of fees and demands refused, and all other information essential to a full and fair understanding of the methods and affairs of such agencies.

With such laws in operation and fairly enforced much of the complaints of fraud and imposition in connection with the business of employment agencies which are now heard should cease, to the considerable advantage of wage-earners and of honestly conducted agencies.

LABOR ORGANIZATION.

The organization of wage-earners, according to their respective avocations, into societies and coöperative bodies for the purpose of protecting their respective interests, improving the condition of their employment, and maintaining and increasing the price received for their labor, as well as mutually to sustain and assist each other in time of sickness and disaster, is a matter so important, and the influence of such organization upon all questions of industrial enterprise and development within the State is so great, that the fact that it has never heretofore received prominent notice by this Bureau, or by any other State or Municipal authority in California, is remarkable. It cannot be said that the wage-earners here are lacking in intelligent progressiveness, for certainly in no State in the Union are they more alive to the importance of intelligent organization as a highway to better things for the wage-worker; and this prompts me to believe that the following data regarding labor organization in California, lacking in completeness though it may be, will in some degree fill a heretofore marked vacancy in the economic and vital statistics of the community.

In collecting and assorting the said data, I called temporarily to my assistance Mr. W. Macarthur, a member of the San Francisco Labor Council, and for a long time editor of the Coast Seaman's Journal, who, by reason of his long experience in labor matters, seemed to me well fitted for the work, and to his valuable help I am indebted in large part for whatever merit may appear in the following presentation of statistics and figures pertaining to this subject.

As a preliminary step the questions appearing in the following table (No. 1) were mailed to each labor organization within the State, the existence of which was known to us, or knowledge of which could be secured by us in any way:

TABLE No. 1.

1. Name of organization.
2. Where located.
3. Name of Secretary.
4. Address of Secretary.
5. Date of foundation of organization.
6. Total number of members May 31, 1900.
7. Per cent of workers in avocation in vicinity who are members.
8. Present rate of wages.
9. Present number of hours of labor, per day's work, required.

10. Number of members steadily employed during quarter next preceding May 31, 1900

11. Average number of days per member per month of enforced idleness during said quarter.

12. Changes, if any, in wages paid, hours of labor per day's work required, or in numerical membership of organization, occurring between June 1, 1896, and May 31, 1900.

13. Death or sick benefits, if any, paid to members or their families in case of death, sickness, or disability.

14. Name and address of National Body affiliated with.

15. Wages and number of hours per diem of unorganized workers in same avocation in same locality.

16. General remarks as to the condition of the avocation as regards employment therein, and suggestions as to legislation which is thought would be beneficial to wage-workers.

It will be seen that the scope of the above inquiries embraces all features of labor organization which are of public interest or concern in reaching an understanding as to the status of such organization, its relation to the State and to Society, and the methods best fitted to direct its potentialities toward the general good. No feature in the conduct of labor organizations generally has been omitted which would in any way affect the conclusions arrived at as regards their *public character.*

From the replies received to the above table of inquiries, Table No. 2 has been compiled, as also the tables thereafter following. Table No. 2 is designed to present as complete a directory or roster of the labor organizations of the State as it has been possible for us to compile from the information and data returned. It is not hoped that it is fully complete or correct. It is possible that some few of the organizations of the State have been omitted from it, and wherever such may be the case, we can only say that we exceedingly regret that it is so, and it has only occurred because we were unable, with diligent use of the means at our command, to get information concerning such organizations.

TABLE No. 2.

Avocation, Name, Location, and Local Number of Organization; Name and Address of Secretary; and Name of National Order Affiliated With.

Name of Organization.	Local No.	Where Located.	Name of Secretary.	Address of Secretary.	National Order Affiliated With.
Barbers' Association of Pacific Coast		115 Turk St., San Francisco			
Barbers' Union	148	102 O'Farrell St., San Francisco	I. Less	36 Sixth St., San Francisco	I. B. U., Cleveland, O.
Barbers' International Union	134	14th and Clay Sts., Oakland	C. W. Presher	14th and Clay Sts., Oakl'd	I. B. U., Cleveland, O.
Barbers' Union		1013 Tenth St., Sacramento			
French Bakers' Union		810 Pacific St., San Francisco	A. Castex	823 Pacific St., San Fran.	I. Bakers' U., Clevel'd, O
German Bakers' Union	21	115 Turk St., San Francisco			
Bakers' Union	37	Los Angeles	L. Brower	112½ W. 3d St., L. Angeles	B. & Conf. I. U., Cleve., O.
Bakers' Union	85	1013 Tenth St., Sacramento	C. H. Johnson	816 26th St., Sacramento	B. & Conf. I. U., Cleve., O.
Journeymen Bakers' Union	24	115 Turk St., San Francisco	C. Rossberg	115 Turk St., San Fran.	B. & Conf. I. U., Cleve., O.
National Union of Brewery Workmen	7	1159 Mission St., San Francisco	E. Koenig	1159 Mission St., San Fran.	N. U. B. W. of the U. S.
Bottlers' Union	102	1159 Mission St., San Francisco	A. R. Andre	1159 Mission St., San Fran.	N. U. B. W. of the U. S.
Branch Union of Brewery Workmen	2	San José			
Branch Union of Brewery Workmen	3	32 Bay Front, S. San Diego	L. Kindel	32 Bay Front, San Diego	Fed. of San Diego
Branch Union of Brewery Workmen	6	Sacramento			
Branch Union of Brewery Workmen	7	122 N. Utica St., Los Angeles	E. Krugelsteiner	122 N. Utica St., L. Ang'ls	
Branch Union of Brewery Workmen	102	2113 O St., Sacramento		2113 O St., Sacramento	N. U. B. W. of the U. S
Beer-Drivers' Union		121 Eddy St., San Francisco			
Bookbinders' Prot. and Benev. Ass'n		102 O'Farrell St., San Francisco	L. G. Wolfe	765 Fifth St., Oakland	
Bookbinders' Union	63	820 W. Fortieth St., Los Angeles	Chas. Hesse	820 W. 40th St., L. Angeles	I. B. of Bookbinders
Bookbinders' Union		1013 Tenth St., Sacramento			
Nat. Boot and Shoe Workers' Union	216	San Francisco			
Bicycle Workers' Union		1058 Broadway, Oakland			
Boilermakers' Brotherh'd of America	148	Vallejo	Robert Strehl	107 Florida St., Vallejo	Boilermak'r Bro'd of Am.
Boilermakers' Brotherh'd of America	25	Cambrian Hall, San Francisco			
Boilermakers' Union		1013 Tenth St., Sacramento			
Journeymen Butchers' Union		909½ Market St., San Francisco			
Brickhandlers' P. and B. Union		909 Market St., San Francisco			
Bricklayers' Union		121 Eddy St., San Francisco	C. Wagner	47 Pierce St., San Fran.	
Bricklayers' Union		1058 Broadway, Oakland			
Bricklayers' Union		1013 Tenth St., Sacramento	Frank Henley	1716 14th St., Sacramento	
Bricklayers' Union		112½ W. Third St., Los Angeles			
U. B. C. and J. of America	22	1133 Mission St., San Francisco	W. E. Smith	335 27th St., San Fran.	B. C. and J. of America
U. B. C. and J. of America	95	Stockton and Union Sts., S. F.	V. Maggio	518 Union St., San Fran.	B. C. and J. of America
U. B. C. and J. of America	423	915½ Market St., San Francisco	J. J. Williams	213 12th St., San Fran.	B. C. and J. of America
U. B. C. and J. of America	483	915½ Market St., San Francisco	Guy Lathrop	915½ Market St., San Fran.	B. C. and J. of America
U. B. C. and J. of America	616	915½ Market St., San Francisco	J. E. Maneval	915½ Market St., San Fran.	B. C. and J. of America
U. B. C. and J. of America	304	1159 Mission St., San Francisco	Henry Conrad	2953 Harrison St., S. F.	B. C. and J. of America

U. B. C. and J. of America	194	Central Av. & Regents, Alam'da	J. E. Lewis	828 Oak St., Alameda	B. C. and J. of America
U. B. C. and J. of America	36	1058 Broadway, Oakland	R. Reed	1225 Chestnut St., Oakland	B. C. and J. of America
U. B. C. and J. of America	550	1058 Broadway, Oakland	R. M. Hamb	1829 Myrtle St., Oakland	B. C. and J. of America
U. B. C. and J. of America	332	112½ W. Third St., Los Angeles	E. J. Cole	1017 E. 7th St., L. Angeles	B. C. and J. of America
U. B. C. and J. of America	426	112½ W. Third St., Los Angeles	C. C. Ford	623 W. 37th St., L. Angeles	B. C. and J. of America
U. B. C. and J. of America	235	532 Market St., Riverside	W. S. Barber	532 Market St., Riverside	B. C. and J. of America
U. B. C. and J. of America	316	8th and Empire Sts., San José	W. Reinhold	8th & Empire Sts., S. José	B. C. and J. of America
U. B. C. and J. of America	162	San Mateo	Louis Huyke	San Mateo	B. C. and J. of America
U. B. C. and J. of America	35	San Rafael	L. Johnson	Box 194, San Rafael	B. C. and J. of America
U. B. C. and J. of America	180	573 Kentucky St., Vallejo	I. Christenson	573 Kentucky St., Vallejo	B. C. and J. of America
U. B. C. and J. of America	586	1013 Tenth St., Sacramento	C. C. Hall	1317 O St., Sacramento	B. C. and J. of America
Amalgamated Society of Carpenters		915½ Market St., San Francisco			
Shinglers' Union		1058 Broadway, Oakland	L. M. Hosmer	416 17th St., Oakland	
Cigar-Packers' Union		539 California St., San Francisco			
Cigarmakers' Union	228	368 Jessie St., San Francisco	J. Ramon	729 Pine St., San Fran.	C. I. U. of America
Cigarmakers' Union	248	1 Ahler's Court, San Fran	W. Rehker	1 Ahler's Court, San Fran.	C. I. U. of America
Cigarmakers' Union	225	Box 198, Sta. C., Los Angeles	H. E. Martens	813 E. Adams St., L. Angl's	C. I. U. of America
Cigarmakers' Union	238	Sacramento	M. Wagener	Box 7, Sacramento	C. I. U. of America
Cigarmakers' Union	253	1106 24th St., Oakland	T. Feeny	1106 24th St., Oakland	C. I. U. of America
Cigarmakers' Union	291	Box 835, San José	F. J. Hepp	Box 835, San José	C. I. U. of America
Cigarmakers' Union	332	1039 Fourth St., San Diego	F. C. Ferris	1039 4th St., San Diego	C. I. U. of America
Clerks' International Protective Ass'n	373	Vallejo	C. C. Bowman	928 Sutter St., Vallejo	
Cooks and Waiters' Union		1058 Broadway, Oakland			
Cooks' Ass'n of Pacific Coast		San Francisco			
Pacific Coast Waiters' Ass'n		413 Stockton St., San Francisco	W. E. Collins	413 Stockton St., San Fran.	
Cement-Workers' Union		915½ Market St., San Francisco	R.H.Wunderlich	32–*a* Rausch St., San Fran.	
Cement-Workers' Union		1058 Broadway, Oakland			
Cloakmakers' Union		915½ Market St., San Francisco	Chas. Boyarsky	627 Larkin St., San Fran.	
Confectioners' Union		115 Turk St., San Francisco			
Coopers' Union		102 O'Farrell St., San Francisco	A. Oberfeld	309 Third St., San Fran.	Coopers' I.U. of N. Am.
Draymen and Team ters' Union		121 Eddy St., San Francisco			
Derrickmen and Engineers' Union		915½ Market St., San Francisco	Chas. Scholtz	915½ Market St., San Fran.	
Marine Engineers' Benev. Ass'n		36 East St., San Francisco	Wm. Warrin	36 East St., San Fran.	N. M. E. B. Ass'n
Amalgamated Society of Engineers		153 Second St., San Francisco	Wm. Read	153 Second St., San Fran.	
Brotherhood of Engineers	161	16th and Valencia Sts., S. F.	E. A. Taylor	3664 19th St., San Fran.	
Brotherhood of Locomotive Engineers	283	7th and Peralta Sts., Oakland	G. W. Randall	1423 Spruce St., Berkeley	G. I. B. of L. E.
Brotherhood of Locomotive Engineers	110	Sacramento	J. B. Mathews	2306 M. St., Sacramento	G. I. B. of L. E.
Brotherhood of Locomotive Engineers	5	Main and Leroy Sts., L. Angeles	J. T. Kearney	1446 S. Fernando St., L. Angl's	G. I. B. of L. E.
Brotherhood of Locomotive Engineers	398	I. O. O. F. Hall, S. Bernardino	W. E. Blackman		G. I. B. of L. E.
Brotherhood of Locomotive Engineers	415	Rocklin			G. I. B. of L. E.
Brotherhood of Locomotive Engineers	425	Box 93, Dunsmuir	D. Freel	Box 93, Dunsmuir	G. I. B. of L. E.
Brotherhood of Locomotive Engineers	126	Box 36, Kern	G. G. Hutchings	Box 36, Kern	G. I. B. of L. E.
Order of Railway Conductors	115	120 O'Farrell St., San Francisco	T. Billingslea	317 Turk St., San Fran.	Order Ry. Conductors
Order of Railway Conductors	364	Oakland	C. E. Houck	1145 E. 19th St., Oakland	Order Ry. Conductors
Order of Railway Conductors	195	Sacramento	Geo. W. Lewis	1031 E St., Sacramento	Order Ry. Conductors

TABLE No. 2—Continued.

Name of Organization.	Local No.	Where Located.	Name of Secretary.	Address of Secretary.	National Order Affiliated With.
Order of Railway Conductors	111	107½ N. Main St., Los Angeles	J. W. Benjamin	Box 935, Los Angeles	Order Ry. Conductors
Order of Railway Conductors	282	Needles	C. H. Richardson	Box 19, Needles	Order Ry. Conductors
Brotherhood of Locomotive Firemen	143	7th and Peralta Sts., Oakland	J. A. Negrich	1356½ 10th St., W. Oakland	Grand Lodge, B. L. F.
Brotherhood of Locomotive Firemen	260	Sacramento	C. E. Anderson	418 8th St., Sacramento	Grand Lodge, B. L. F.
Brotherhood of Locomotive Firemen	90	Los Angeles	J. E. Bass	794 Central Ave., Los Ang.	Grand Lodge, B. L. F.
Brotherhood of Locomotive Firemen	97	Los Angeles	N. O. Stafford	123 North Ave., Los Ang.	Grand Lodge, B. L. F.
Brotherhood of Locomotive Firemen	91	16th and Valencia Sts., S. F.	R. J. Duggan	238 N. River St., San José	Grand Lodge, B. L. F.
Brotherhood of Locomotive Firemen	58	Rocklin	C. L. Deming	Box 85, Rocklin	Grand Lodge, B. L. F.
Brotherhood of Locomotive Firemen	139	Box 48, Kern	A. M. McArthur	Box 48, Kern	Grand Lodge, B. L. F.
Brotherhood of Locomotive Firemen	312	Dunsmuir	E. J. Franklin	Dunsmuir	Grand Lodge, B. L. F.
Brotherhood of Locomotive Firemen	314	San Bernardino	H. F. Eberhart	166 I St., San Bernardino	Grand Lodge, B. L. F.
Brotherhood of Locomotive Firemen	386	San Diego	D. L. Marrs	957 Columbia St., San Diego	Grand Lodge, B. L. F.
Brotherhood of Locomotive Firemen	327	Needles	D. Bristow	Box 27, Needles	Grand Lodge, B. L. F.
Brotherhood of Railroad Trainmen	198	120 O'Farrell St., San Francisco	J. A. Lane	1612 Turk St., San Fran.	B. of R. T.
Brotherhood of Railroad Trainmen	71	Oakland	G. B. McClellan	1515 Eighth St., Oakland	B. of R. T.
Brotherhood of Railroad Trainmen	73	Kern	H. B. Buck	K. of P. Hall, Kern	
Brotherhood of Railroad Trainmen	74	Los Angeles	W. C. Auble	458 Colyton St., Los Ang.	B. of R. T.
Brotherhood of Railroad Trainmen	278	San Bernardino	G. L. Barrows	Davis Hall, San Ber'dino	B. of R. T.
Brotherhood of Railroad Trainmen	340	1529 Eighth St., Sacramento	Wm. J. O'Brien	1529 8th St., Sacramento	B. of R. T.
Brotherhood of Railroad Trainmen	420	Stockton	W. A. Thomas	Occidental Hotel, Stockt'n	B. of R. T.
Brotherhood of Railroad Trainmen	430	Needles	F. C. Reedy	Needles	B. of R. T.
Brotherhood of Railroad Trainmen	458	Dunsmuir	J. B. Duncan	Box 55, Dunsmuir	B. of R. T.
Order of Railroad Telegraphers	53	San Francisco	B. A. Meyer	Station L., San Francisco	Order of Ry. Tel.
Marine Firemen's Union		46 Steuart St., San Francisco	John Bell	46 Steuart St., San Fran.	
Int'l Brotherhood Electrical Workers	61	112½ W. Third St., Los Angeles	M. B. Davidson	627 Crocker St., Los Ang.	A. F. of Labor
Int'l Brotherhood Electrical Workers	6	120 O'Farrell St., San Francisco	A. E. Yoell	657 Stevenson St., S. F.	Central Lodge
Int'l Brotherhood Electrical Workers	36	Sacramento	C. W. Beanton	716 P St., Sacramento	
Int'l Brotherhood Electrical Workers	61	Los Angeles	H. J. Francis	1816 Michigan Ave., L. A.	
Int'l Brotherhood Electrical Workers	64	Oakland	H. P. Renton	867 19th St., Oakland	
Glassblowers' Union	3	B. B. Hall, San Francisco	B. B. Hall	San Francisco	
Granite-Cutters' Union		1159 Mission St., San Francisco	J. J. Casey	62 Julian Ave., San Fran.	National body
Garment-Workers' Union		1058 Broadway, Oakland			
Horseshoers' Union		102 O'Farrell St., San Francisco			
'Longshoremen's Union		249 H St., San Diego	J. Robertson	249 H. St., San Diego	
'Longshoremen's S. F. Prot. Ass'n		East and Mission Sts., S. F.	J. J. Farris	547 Howard St., San Fran.	
'Longshoremen's Union		1056 Broadway, Oakland			
Laborers' Protective Association		1159 Mission St., San Francisco	W. O'Donnell	261 Minna St., San Fran.	
Laborers' and Hod-Carriers' Union		819 Howard St., San Francisco			
Lathers' Union		1058 Broadway, Oakland			

Lathers' Union (wood, wire & metal)		Los Angeles			
Lithographers' Union	17	Alcazar Bldg., San Francisco	Chas. M. Krieger	817 Valencia St., S. F.	L. I. P. B. Ass'n of U. S.
'Longshore Lumbermen's Prot. Ass'n		1133 Mission St., San Francisco	J. E. Riordan	638-*a* Jessie St., San Fran.	
'Longshore Lumbermen's Prot. Ass'n		Second and C Sts., Eureka	J. H. Halloran	Second and C Sts., Eureka	Int'l L'gsh'mns Ass'n
Mantel, Grate, and Tile-Setters' Union		1133 Mission St., San Francisco			
Marble Cutters and Finishers' Union		915½ Market St., San Francisco			
Milkers' Protective Association		526 Montgomery St., S. F.	August Iten	526 Montgomery St., S. F.	
Milkers' Protective Association		142 Main St., Los Angeles	J. D. Reymert	17 Law Block, Los Ang.	A. F. of Labor
Milkers' Protective Association	1	918 J St., Sacramento			
Machinists' Int'l Association	68	Alcazar Bldg., San Francisco	Jas. Maginnis	454 Page St., San Fran.	I. A. of Machinists
Machinists' Int'l Association	252	Vallejo	Jas. Linn	Box 166, Vallejo	I. A. of Machinists
Machinists' Int'l Association	15	San Bernardino	Wm. Brassington	Box 155, San Bernardino	I. A. of Machinists
Machinists' Int'l Association	311	127 N. Main St., Los Angeles	W. C. Wells	418 S. Sickel St., Los Ang.	I. A. of Machinists
Metal Buffers and Polishers' Union		1133 Mission St., San Francisco	J. J. O'Brien	749 Howard St., San Fran.	M. P. B. P. & B. I. U.
Metal-Roofers' Union		909 Market St., San Francisco			
Metal-Workers' Union; Amal. Sheet	104	121 Eddy St., San Francisco	T. W. Madden	1249 McAllister St., S. F.	A. S. M. W. Int'l Assn
Miners' Western Federation	61	Bodie, Mono County	A. D. Redding	Bodie, Mono County	Western Fed. Miners
Miners' Western Federation	47	Confidence, Tuolumne County	H. Mitchell	Confidence, Tuolumne Co.	Western Fed. Miners
Miners' Western Federation	90	Grass Valley, Nevada County	M. M. Mitchell	Grass Valley	Western Fed. Miners
Miners' Western Federation	70	Hedges, San Diego County	J. A. Vaughn	Hedges, San Diego Co.	Western Fed. Miners
Miners' Western Federation	51	Mojave	Thos. Morrissey	Mojave	Western Fed. Miners
Miners' Western Federation	44	Randsburg	G. W. Andrews	Randsburg	Western Fed. Miners
Miners' Western Federation	73	Quartz Mountain, Tuolumne Co.	W. G. Herman	Box 94, Quartz Mt., Tuol. Co.	
Miners' Western Federation	39	Big Oak Flat	R. W. Byrn	Big Oak Flat	Western Fed. Miners
Musicians' Mutual Protective Union		421 Post St., San Francisco	S. Davis	421 Post St., San Francisco	A. F. of Musicians
Musicians' Mutual Protective Union		912 Fourteenth St., Sacramento	E. A. Platt	912 14th St., Sacramento	A. F. of Musicians
Musicians' Mutual Protective Union		220½ S. Main St., Los Angeles	J. Green	Box 505, Los Angeles	
Musicians' Mutual Protective Union		Broadway, Oakland	Ed. L. Merritt	Kohler & Chase, Brdwy, Oak.	A. F. of Musicians
Molders' Union	164	1133 Mission St., San Francisco	W. P. McCabe	212 12th St., San Francisco	I. M. I. U. of N. A. & C.
Molders' Union	199	1013 Tenth St., Sacramento			
Molders' Union	164	Vallejo	Frank Roney	Vallejo	I. M. I. U. of N. A. & C.
Newsboys' Union		Los Angeles			
Newspaper-Carriers' Union (S. F.)		102 O'Farrell St., San Francisco			
Painters, Decorators, etc., Bro. of Am.	73	909 Market St., San Francisco	Walter Luke	119-*a* 6th St., San Fran.	P. D. & P. Bro. of Am.
Painters, Paperhangers, & Frescoers' Brotherhood of America	131	915½ Market St., San Francisco	A. Park	915½ Market St., S. F.	P. D. & P. Bro. of Am.
Painters' (sign and pict.) Bro. of Am.	132	20 Eddy St., San Francisco	C. H. Tupper	512 Waller St., San Fran.	P. D. & P. Bro. of Am.
Painters' (varn. and pol.) Bro. of Am.	134	915½ Market St., San Francisco	W. M. Page	7 Morris Ave., San Fran.	P. D. & P. Bro. of Am.
Painters' Brotherhood of America	127	1058 Broadway, Oakland	W. H. Macrimmon	Shasta Hotel, Oakland	P. D. & P. Bro. of Am.
Painters' Brotherhood of America	136	117 Turk St., San Francisco	F. K. Burkhardt	437 Grove St., San Fran.	P. D. & P. Bro. of Am.
Painters' Brotherhood of America	92	Pasadena			
Patternmakers' Union		55 Third St., San Francisco	R. J, Raymond	3227 21st St., San Fran.	P. L. of N. M.
Plasterers' Union		927 Mission St., San Francisco			
Plasterers' Union (contracting)		40 New Montgomery St., S. F.	Geo. W. Glosser	1619 Eddy St., San Fran.	
Plasterers' Union		1058 Broadway, Oakland			

TABLE No. 2—Continued.

Name of Organization.	Local No.	Where Located.	Name of Secretary.	Address of Secretary.	National Order Affiliated With.
Plasterers' International Association	2	112½ W. Third St., Los Angeles	H. D. Maloney	862 E. 47th St., Los Ang.	O. P. Int'l Ass'n
Pavers' Union (Pacific Coast)		120 Ninth St., San Francisco	J. McGinley	530½ Ninth St., S. F.	
Printing Pressmen's and Assistants' Union of N. A. (International)	24	23 Davis Street, San Francisco	Jos. C. Cotter	23 Davis St., San Fran.	I. P. P. & A. U. of N.A.
Printing Pressmen's (Web Pressmen) Union of N. A. (International)	4	208 Diamond St., San Francisco	Harry Meiran	208 Diamond St., S. F.	I. P. P. & A. U. of N.A.
Printing (Feeders and Helpers) Union of N. A.	37	1003 Bartlett St., Los Angeles	A. L. Tournoux	1003 Bartlett St., Los Ang.	I. P. P. & A. U. of N.A.
Printing Pressmen's Union of N. A.	78	124½ W. Third St., Los Angeles	Benson Stead	517 Hancock St., Los Ang.	I. P. P. & A. U. of N.A.
Printing Pressmen's Union of N. A.	60	Tenth St., bet. J & K, Sacram'to	P. T. Johnston	1621 F St., Sacramento	I. P. P. & A. U. of N.A.
Printers' Prot. Fraternity	33	"Times" Office, Los Angeles	W. A. Rennie	"Times" Office, Los Ang.	I. P. P. Fraternity
Photo-Engravers' Union (S. F.)		———, San Francisco	Thos. Wall	2314 Mission St., S. F.	Int'l Typogr'cal Union
Pile-Drivers & B'dge-Builders' Union	1	26 Sacramento St., S. F.	J. V. Beck	922 Natoma St., S. F.	
Plumbers' G. & S. F. Ass'n (Jour.)	69	Alcazar Building, S. F.			
Plumbers' Union		Alcazar Building, S. F.			
Plumbers' Union		1013 Tenth St., Sacramento			
Plumbers' Union of Alameda County		1058 Broadway, Oakland	Geo. Stevenson	1371 N. Broadway, Oakld.	
Plumbers' G. & S. Fitters' (Jour.)	78	Box 568, Los Angeles	T. J. Bishop	Box 568, Los Angeles	
Rammers' Union		Hibernia Hall, San Francisco			
Riggers and Stevedores' Union		808 Montgomery St., S. F.			
Sailors' Union of the Pacific		East and Mission Sts., S. F.	A. Furuseth	San Francisco	I. S. U. of Am.
Sailors' Union of the Pacific		Eureka, Humboldt County	F. Taucher	Box 327, Eureka	I. S. U. of Am.
Sailors' Union of the Pacific		Box 1755, San Pedro	H. Ohlson	Box 1755, San Pedro	I. S. U. of Am.
Sailors' Union of the Pacific		Box 51, San Diego	J. Card	Box 51, San Diego	I. S. U. of Am.
Ship and Steamboat Joiners' Union		14 Folsom St., San Francisco	T. Westoby	14 Folsom St., San Fran.	Am. Fed. of Labor
Shipwrights' Union (Journeymen)		320 Post St., San Francisco			
Shipcalkers' Association		Steuart & Mission Sts., S. F.	S. M. Taylor	55 Mission St., San Fran.	
Shipjoiners' Protective Association		Sacramento Street, Vallejo	T. Muirhead	Sacramento St., Vallejo	Federated Trades
Sailmakers' Union		121 Eddy St., San Francisco	M. C. Hencken	1358 Vallejo St., San Fran.	
Scavengers' Protective Union		423 Broadway, San Francisco			
Surveyors' Association (Lumber)		9 Mission St., San Francisco			
Stereotypers' Union	29	14 Third St., San Francisco	Emile Dengle	"Examiner" Office, S. F.	Int'l Typogr'cal Union
Stone-Cutters' Ass'n of N. A. (Jour.)		915½ Market St., San Francisco	W. Drennan	915½ Market St., S. F.	J. S. A. of N. Am.
Stone-Cutters' Ass'n of N. A. (Jour.)		Box 8, Santa Barbara	Thomas B. Lee	Box 8, Santa Barbara	J. S. A. of N. Am.
Tailors' Prot. & Benev. Union (Jour.)		421 Post St., San Francisco	Edw. Heluquist	705 Hyde St., San Fran.	
Tailors' Union (Ladies')		115 Turk St., San Francisco			
Tailors' Union		220½ S. Main St., Los Angeles			
Tailors' Union		1058 Broadway, Oakland			
Typographia Union	22	539 California St., San Francisco			
Typographical Union	21	533 Kearny St., San Francisco	H. L. White	533 Kearny St., San Fran.	Int'l Typogr'cal Union

Typographical Union	207	Eureka	J. M. Speegle	Box 398, Eureka	Int'l Typogr'cal Union
Typographical Union	144	Fresno City	J. C. Hodge	Franklin Ptg. Co., Fresno	Int'l Typogr'cal Union
Typographical Union	174	Box 570, Los Angeles	R. S. Woodside	Box 570, Los Angeles	Int'l Typogr'cal Union
Typographical Union	223	Marysville	E. E. Grover	Care "Appeal," Marysville	Int'l Typogr'cal Union
Typographical Union	36	371 Eleventh St., Oakland	C. E. Backess	1072 E. 17th St., E. Oaklnd	Int'l Typogr'cal Union
Typographical Union	254	441 Comer St., Riverside	Willis Hallock	441 Comer Ave., Riverside	Int'l Typogr'cal Union
Typographical Union	46	1013 Tenth St., Sacramento	Tom A. Cody	Box 392, Sacramento	Int'l Typogr'cal Union
Typographical Union	84	San Bernardino	Sydney Waite	Box 876, San Bernardino	Int'l Typogr'cal Union
Typographical Union	221	San Diego	B. A. Neff	Box 328, San Diego	Int'l Typogr'cal Union
Typographical Union	56	Stockton	S. B. Coates	Box 140, Stockton	Int'l Typogr'cal Union
Typographical Union	231	San José	J. Marr	San José	Int'l Typogr'cal Union
Theatrical Employes' Prot. Union	16	414 Mason St., San Francisco	Carl Taylor	414 Mason St., San Fran	N. A. T. S. Employés
Theatrical Employes' Prot. Union	33	Los Angeles	Chas. E. Feehan	Box 799, Los Angeles	N. A. T. S. Employés
Theatrical Employes' Prot. Union	50	521 K St., Sacramento	Max Ginsberg	521 K St., Sacramento	N. A. T. S. Employés
Amalgamated Woodworkers	------	———, San Francisco	Henry Thieler	821 Hampshire St., S. F.	

By Table No. 2 it appears that there are within the State 217 distinct lodges or bodies of organized labor, of which 90, or about 41 per cent, are located in San Francisco; 26, or about 12 per cent, in Los Angeles; 23, or about 10 per cent, in Oakland; 20, or about 9 per cent, in Sacramento; 6 in San Diego, 5 in Vallejo, 5 in San José, and the remainder scattered among various localities throughout the State.

By the said table it appears, again, that some 81 distinct avocations or callings are represented among the labor organizations in question, and, so far as data were given, that about 127 of such organizations are affiliated with central national or international organizations. I say so far as data were given; as it must be noted that from some of the organizations which are undoubtedly thus affiliated with national bodies no returns were received.

It not being possible to, in one table, include all the statistical details which it is desired to present, the local number of the organization has, in each case where given, been repeated in each following table, to the end that where it is desired to refer to all the data respecting any one lodge or organization, such organization can be readily referred to in each respective table.

Of the said 217 organizations, 136, or about 62 per cent, gave returns more or less complete. Bearing in mind my remarks in the introduction to this report relative to the difficulty of obtaining replies to statistical inquiries, it will be seen that this is a surprisingly high percentage of returns, and testifies to the interest felt by the membership of Organized Labor in such matters.

Table No. 3 shows the membership, numerically, of the respective organizations on May 1, 1900 (so far as data relating thereto were received), the per cent of increase or decrease therein since June 1, 1896, and the percentage of the workers of the respective avocations, in the vicinity, who are members of the organization reporting.

TABLE No. 3.

Name of Organization.	Local No.	Total Membership May 31, 1900	Per Cent of Increase in Membership Since June 1, 1896	Per Cent of Decrease in Membership Since June 1, 1896	Percentage of Workers in Same Avocation in Vicinity who are Members
Barbers' Association of Pacific Coast	-------	-------	-------	-------	-------
Barbers' Union	148	62	-------	25	25
Barbers' International Union	134	-------	-------	-------	25
Barbers' Union	-------	-------	-------	-------	-------
Bakers' Union (French)	29	29	-------	-------	-------
Bakers' Union (German)	21	-------	-------	-------	-------
Bakers' Union	37	25	5	-------	50
Bakers' Union	85	35	-------	-------	100
Bakers' Union (Journeymen)	24	35	-------	-------	-------
Brewery Workmen (National Union)	7	580	300	-------	100
Bottlers' Union	102	108	-------	-------	80

TABLE No. 3—Continued.

Name of Organization.	Local No.	Total Membership May 31, 1900	Per Cent of Increase in Membership Since June 1, 1896	Per Cent of Decrease in Membership Since June 1, 1896	Percentage of Workers in Same Avocation in Vicinity who are Members
Branch Union of Brewery Workmen	2				
Branch Union of Brewery Workmen	3	4			
Branch Union of Brewery Workmen	6				
Branch Union of Brewery Workmen	7				
Branch Union of Brewery Workmen	102	18			
Beer-Drivers' Union					
Bookbinders' Protective and Benevolent Ass'n.		40		30	40
Bookbinders' Union	63	15			100
Bookbinders' Union					
Boot and Shoe Workers' National Union	216				
Bicycle-Workers' Union					
Boilermakers' Brotherhood of America	148	81	50		100
Boilermakers' Brotherhood of America	25				
Boilermakers' Union					
Butchers' Union (Journeymen)					
Brickhandlers' Protective and Benev. Union					
Bricklayers' Union		225			100
Bricklayers' Union					
Bricklayers' Union		28	10		96
Bricklayers' Union					
Carpenters and Joiners of America—U. B.	22	752	15		90
Carpenters and Joiners of America—U. B.	95	33			
Carpenters and Joiners of America—U. B.	423	295			90
Carpenters and Joiners of America—U. B.	483	400			95
Carpenters and Joiners of America—U. B.	616	40		2	75
Carpenters and Joiners of America—U. B.	304	93			95
Carpenters and Joiners of America—U. B.	194	36			50
Carpenters and Joiners of America—U. B.	36	304	30		
Carpenters and Joiners of America—U. B.	550	150			75
Carpenters and Joiners of America—U. B.	332	43		85	25
Carpenters and Joiners of America—U. B.	426	134	75		25
Carpenters and Joiners of America—U. B.	235	25			50
Carpenters and Joiners of America—U. B.	316	85			85
Carpenters and Joiners of America—U. B.	162	53			100
Carpenters and Joiners of America—U. B.	35	37			95
Carpenters and Joiners of America—U. B.	180				
Carpenters and Joiners of America—U. B.	586	30			40
Carpenters—Amalgamated Society of					
Carpenters—Shinglers' Union	26				80
Cigar-Packers' Union					
Cigarmakers' Union	228	250		20	95
Cigarmakers' Union	248	9			10
Cigarmakers' Union	225	45	25		90
Cigarmakers' Union	238	59			67
Cigarmakers' Union	253	42	5		90
Cigarmakers' Union	291	36			80
Cigarmakers' Union	332	18			100
Clerks' International Protective Association	373	24	25		75
Cooks and Waiters' Union					
Cooks' Association—Pacific Coast					
Coast (Pacific) Waiters' Association		450	75		50
Cement-Workers' Union		350	100		100
Cement-Workers' Union					
Cloakmakers' Union		70	20		75
Confectioners' Union					
Coopers' Union		138			66
Draymen and Teamsters' Union					
Derrickmen and Engineers' Union		104			100
Engineers' Benevolent Association, Marine		800			
Engineers, Amalgamated Society of				1	
Engineers, Brotherhood of Locomotive	161	50	1		98
Engineers, Brotherhood of Locomotive	283	145			98
Engineers, Brotherhood of Locomotive	110	60			95
Engineers, Brotherhood of Locomotive	5	103			97

TABLE No. 3—Continued.

Name of Organization.	Local No.	Total Membership May 31, 1900	Per Cent of Increase in Membership Since June 1, 1896	Per Cent of Decrease in Membership Since June 1, 1896	Percentage of Workers in Same Avocation in Vicinity who are Members.
Engineers, Brotherhood of Locomotive	398	50			
Engineers, Brotherhood of Locomotive	415	35			
Engineers, Brotherhood of Locomotive	425	30			
Engineers, Brotherhood of Locomotive	126	46			97
Electrical Workers, Intern'l Brotherhood of	61	125	130		75
Electrical Workers, Intern'l Brotherhood of	6		50		75
Electrical Workers, Intern'l Brotherhood of	36				
Electrical Workers, Intern'l Brotherhood of					
Electrical Workers, Intern'l Brotherhood of	64				
Order of Railway Conductors	115	91		20	95
Order of Railway Conductors	364				
Order of Railway Conductors	195				
Order of Railway Conductors	111	134			80
Order of Railway Conductors	282				95
Firemen, Brotherhood of Locomotive	143	58	300		45
Firemen, Brotherhood of Locomotive	260				
Firemen, Brotherhood of Locomotive	90				
Firemen, Brotherhood of Locomotive	97				
Firemen, Brotherhood of Locomotive	91	45	50		10
Firemen, Brotherhood of Locomotive	58	37	500		90
Firemen, Brotherhood of Locomotive	139	79			80
Firemen, Brotherhood of Locomotive	312				
Firemen, Brotherhood of Locomotive	314		100		80
Firemen, Brotherhood of Locomotive	386	17	30		90
Firemen, Brotherhood of Locomotive	327				
Brotherhood of Railroad Trainmen	198	70	50		75
Brotherhood of Railroad Trainmen	71				
Brotherhood of Railroad Trainmen	73				
Brotherhood of Railroad Trainmen	74				
Brotherhood of Railroad Trainmen	278				
Brotherhood of Railroad Trainmen	340	95	80		98
Brotherhood of Railroad Trainmen	420	28			90
Brotherhood of Railroad Trainmen	430	38	25		90
Brotherhood of Railroad Trainmen	458				
Order of Railroad Telegraphers	53		400		80
Firemen's Union, Marine		1,080			
Glassblowers' Union	3				
Granite-Cutters' Union		63			40
Garment-Workers' Union					
Horseshoers' Union					
'Longshoremen's Union		90			5
'Longshoremen's San Francisco Prot. Ass'n		550	100		50
'Longshoremen's Union					
Laborers' Protective Association		200		25	95
Laborers and Hod-Carriers' Union					
Lathers' Union					
Lathers' Union (Wood, Wire, and Metal)					
Lithographers' Union	17	52			
'Longshore Lumbermen's Protective Ass'n		784			90
'Longshore Lumbermen's Protective Ass'n		85	50		70
Mantel, Grate, and Tile-Setters' Union					
Marble Cutters and Finishers' Union					
Milkers' Protective Association		430			90
Milkers' Protective Association		50			95
Milkers' Protective Association					
Machinists' International Association	68	500	20		30
Machinists' International Association	252				
Machinists' International Association	15				
Machinists' International Association	311	30			12
Metal Buffers and Polishers' Union		34			100
Metal-Roofers' Union					
Metal-Workers' Union (Amalgamated Sheet)	104	30			95
Miners' Western Federation	61	130	16		95
Miners' Western Federation	47	60			

TABLE No. 3—Continued.

Name of Organization.	Local No.	Total Membership May 31, 1900	Per Cent of Increase in Membership Since June 1, 1896	Per Cent of Decrease in Membership Since June 1, 1896	Percentage of Workers in Same Avocation in Vicinity who are Members.
Miners' Western Federation	90	500			
Miners' Western Federation	70	51			
Miners' Western Federation	51				
Miners' Western Federation	44	215			90
Miners' Western Federation	73				
Miners' Western Federation	39	68			60
Musicians' Mutual Protective Union		510			75
Musicians' Mutual Protective Union					
Musicians' Mutual Protective Union					
Musicians' Mutual Protective Union					
Molders' Union of America	164	355	100		98
Molders' Union of America	199				
Molders' Union of America	164–br.				90
Newsboys' Union					
Newspaper-Carriers' Union, San Francisco					
Painters, Decorators, etc., Bro. of America	73	550			40
Painters Paperhangers, and Fresco. Bro. of Am.	131	115	50		75
Painters' (Sign and Picture) Bro. of America	132	57			57
Painters' (Varn. and Pol.) Bro. of America	134	93	30		80
Painters' Brotherhood of America	127	200			95
Painters' Brotherhood of America	136				
Painters' Brotherhood of America	92				
Patternmakers' Union		74	100		70
Plasterers' Union					
Plasterers' Union (Contracting)		47			75
Plasterers' Union					
Plasterers' International Association	2	28		14	
Pavers' Union (Pacific Coast)		35	3		75
Printing Pressmen's and Assistants' Union	24				
Printing Pressmen's Union of North America	4				
Printing (Feeders and Helpers) Union	37	25			95
Printing Pressmen's Union of North America	78	23			
Printing Pressmen's Union of North America	60	24		25	95
Printers' Protective Fraternity	33	53			50
Photo-Engravers' Union		40	50		95
Pile-Drivers and Bridge-Builders' Union	1	325			90
Plumbers, Gas and Steam Fitters' Ass'n	69				
Plumbers' Union					
Plumbers' Union					
Plumbers' Union, Alameda County		70			
Plumbers, Gas and Steam Fit'rs' (Jour.) Union	78	39		50	60
Rammers' Union					
Riggers and Stevedores' Union					
Sailors' Union of the Pacific					
Sailors' Union of the Pacific					
Sailors' Union of the Pacific					
Sailors' Union of the Pacific					
Ship and Steamboat Joiners' Union		167			
Shipwrights' Union (Journeymen)					
Shipcalkers' Association		148			95
Shipjoiners' Protective Association		57			75
Sailmakers' Union		79			
Scavengers' Protective Union					
Surveyors' Association (Lumber)					
Stereotypers' Union	29	42	5		100
Stone-Cutters' Association of North America		118	10		100
Stone-Cutters' Association of North America		14			60
Tailors' Protective and Benevolent Union		300	45		95
Tailors' Union (Ladies')					
Tailors' Union					
Tailors' Union					
Typographia Union					
Typographical Union	21	525			70
Typographical Union	207	14			100

TABLE No. 3—Continued.

Name of Organization.	Local No.	Total Membership May 31, 1900	Per Cent of Increase in Membership Since June 1, 1896	Per Cent of Decrease in Membership Since June 1, 1896	Percentage of Workers in Same Avocation in Vicinity who are Members.
Typographical Union	144				
Typographical Union	174	125			60
Typographical Union	223				
Typographical Union	36	118	25		80
Typographical Union	254	10			90
Typographical Union	46	86			100
Typographical Union	84				
Typographical Union	221				
Typographical Union	56	36			100
Typographical Union	231				
Theatrical Employés' Protective Union	16	102		1	100
Theatrical Employés' Protective Union	33				
Theatrical Employés' Protective Union	50	31			
Amalgamated Woodworkers					

In connection with Table No. 2 it has been noted that of the 217 labor organizations in the State, 136 gave returns. Of the said 136, it appears by Table No. 3 that 120 reported membership as existing May 31, 1900; and that, for the number thus reporting, an aggregate membership of 17,090 is given, which, roughly approximating, justifies a belief that there are, in round numbers, not less than 30,000 wage-earners within the State who are members of labor organizations.

Table No. 3 reveals that the percentage of the wage-earners belonging to an organization in any given avocation and locality, while ranging all the way from 5 to 100, is in most instances given as between 75 and 100 per cent, and justifies the belief that a fair average approximate of such percentage would be 80; which in turn justifies the belief that there are, as wage-earners, in the several avocations represented in Table No. 2, within this State, about 37,500 persons. In connection herewith, however, allowance must be made for the fact that workers, in the several avocations, few in the individual case, but many in the aggregate, are found scattered over the State, remote from the centers of industry, and, usually, not members of labor organizations; and the result of such allowance is twofold: First, that it increases the percentage of wage-earners who are not members of labor organizations; not to a large, but to some, extent. Second, it increases the aggregate number of workers employed in the respective avocations; or, that is to say, the estimate thereof.

Now, again: San Francisco, as naturally would be expected, appears as the labor organization center of the State. Table No. 2 shows that about 41 per cent of the organizations of the State are there located, and an analysis of Table No. 3 shows that the said organizations

located in San Francisco include in their membership about 20,000 persons, or some 66 per cent of the entire labor organization membership of California. This conclusion is reached by figuring from the aggregate membership of the San Francisco organizations reporting membership, which aggregate is found to be some 12,285 members (55 organizations reporting). In connection, however, with such membership in San Francisco, should be noted the fact that of the organizations there located, the membership of the Marine Firemen's Union (1,080), of the Marine Engineers' Association (800), and of the Coast Seamen's Union (not reported, but large in the aggregate), is scattered to all parts of the coast, or possibly, of the world.

Oakland has, approximately (figured from the same basis as in the case of San Francisco), some 3,000 members of labor organizations; Los Angeles, some 2,100; Sacramento, about 1,000; San José, about 300; Vallejo, about 275; and San Diego, about 160. The remainder of such membership in the State is scattered among various localities other than the points named.

Another feature revealed by Table No. 3, which is gratifying to the friends of Organized Labor, is the fact that in almost every case of reported change of membership between June 1, 1896, and May 31, 1900, the change has been toward increase and improvement. In reaching a conclusion as to the percentage of wage-earners in the State who are members of labor organizations (including in the term "wage-earners" all who in any capacity work for wages), consideration must be given to an important circumstance, namely, that it is only in some lines of industry that labor is organized at all. Labor organization is found to flourish best among those avocations requiring skill, and considerable training to become fitted therefor, or which peculiarly require more than ordinary physical endurance, etc. The great army of unskilled, or, as it is more ordinarily termed, common labor, is unorganized; and this is true, too, of a vast array of wage-earners whose work is in its nature clerical. The labor of the farms, of the orchards, of the vineyards, and of the orange groves knows no organization; which brings us to the proposition that while in certain avocations the percentage of labor belonging to organization, as compared with the entire labor engaged in such avocation, is large, the percentage of labor organized, when compared with the entire labor of the State, remains still but small.

TABLE No. 4.

Name of Organization.	Local Number	Number of Hours per Day's Work Required May 31, 1900, of Workers who were Members of the Organization	Number of Hours per Day's Work Required May 31, 1900, of Workers who were Not Members of the Organization	Rate of Wages per Diem May 31, 1900, of Workers in Avocation who were Members of the Organization	Rate of Wages per Diem May 31, 1900, of Workers in Avocation who were Not Members of the Organization	Decrease in Number of Hours per Day's Work Since June 1, 1896	Increase in Numbers of Hours per Day's Work Since June 1, 1896	Increase in Rate of Wages per Diem Since June 1, 1896	Decrease in Rate of Wages per Diem Since June 1, 1896	Number of Members Steadily Employed during Quarter Next Prior to May 31, 1900	Average Number of Days per Month of Enforced Idleness during Quarter Next Prior to May 31, 1900	Condition of Avocation Generally, as Regards Employment therein
								Pr Ct.	Per Cent.	Per Cent.		
Barbers' Association of Pacific Coast												
Barbers' Union	148	14–18	14–18	$2 00e	$1 65				21	100		
Barbers' International Union	134	12–14	15	2 15e								
Barbers' Union												
Bakers' Union (French)		12		1 50b	1 50b					90	0	Good
Bakers' Union (German)	21											
Bakers' Union	37	12	12–18	2 00			2		20	95	1	
Bakers' Union	85	10		2 00						95	0	
Bakers' Union (Journeymen)	24											
Brewery Workmen (National Union)	7	9		2 66	1 75					80	1	
Bottlers' Union	102	9	11	1 91	1 50					90	9	
Branch Union of Brewery Workmen	2											
Branch Union of Brewery Workmen	3	9		1 65	1 65					100		
Branch Union of Brewery Workmen	6											
Branch Union of Brewery Workmen	7											
Branch Union of Brewery Workmen	102	10		1 85								
Beer-Drivers' Union												
Bookbinders' Protective and Benevolent Association		10		3 50	2 75					95		
Bookbinders' Union	63	9	9	3 00	3 00	1				90	0	
Bookbinders' Union												
Boot and Shoe Workers' National Union	216											
Bicycle-Workers' Union												
Boilermakers' Brotherhood of America	148	8		3 60					10	50		
Boilermakers' Brotherhood of America	25											
Boilermakers' Union												

Butchers' Union (Journeymen)												
Brickhandlers' Protective and Benevolent Union										50		
Bricklayers' Union		8		5 00								
Bricklayers' Union												
Bricklayers' Union		8	10	5 00	3 75					50	10	
Bricklayers' Union												
Carpenters and Joiners of America—U. B.	22	8		3 50				16⅔		85		
Carpenters and Joiners of America—U. B.	95	8		3 50		1		40		90		
Carpenters and Joiners of America—U. B.	423	9		2 75	2 75					98		Bad
Carpenters and Joiners of America—U. B.	483	8	9–10	3 50	2 50			40		20	12	
Carpenters and Joiners of America—U. B.	616	8		4 00						60	9	
Carpenters and Joiners of America—U. B.	304	8		3 50				40		75		
Carpenters and Joiners of America—U. B.	194	8		3 25	2 10			25		25	3	
Carpenters and Joiners of America—U. B.	36	8	8	3 50				40		80	5	Good
Carpenters and Joiners of America—U. B.	550	9–10	10	2 75	2 00					95		Bad
Carpenters and Joiners of America—U. B.	332	8		2 50	1 50					95	2	Bad
Carpenters and Joiners of America—U. B.	426	8	9	2 50	1 50			11		99	0	
Carpenters and Joiners of America—U. B.	235	8	8	3 00	2 50					100		
Carpenters and Joiners of America—U. B.	316	8	9–10	3 00	2 00					75		
Carpenters and Joiners of America—U. B.	162	8		3 50	2 00	1		16⅔		98	0	Good
Carpenters and Joiners of America—U. B.	35	8	9	3 50	2 75			16⅔		25	10	
Carpenters and Joiners of America—U. B.	180											
Carpenters and Joiners of America—U. B.	586	9		2 75	2 50					100		Good
Carpenters—Amalgamated Society of												
Carpenters—Shinglers' Union	26	8	8	3 00	2 75			60		75		Good
Cigar-Packers' Union												
Cigarmakers' Union	228	8	16	2 00*e*	90					80	1	
Cigarmakers' Union	225	8	10–14	2 50	1 60				10	80	5	Good
Cigarmakers' Union	248	8	10	2 25	1 50					20	10	
Cigarmakers' Union	238	8		2 50*e*					10	50		
Cigarmakers' Union	253	8	10–12	2 50*e*	1 60					93	4	
Cigarmakers' Union	291	8	10	2 00	2 00					87		Fair
Cigarmakers' Union	332	8							10	75	0	Good
Clerks' International Protective Association	373	14		1 90*f*		2				100	0	
Cooks and Waiters' Union												
Cooks' Association—Pacific Coast												
Waiters' Association—Pacific Coast		10–13	12–14	1 65*e*				20		75		Good
Cement-Workers' Union		8		4 00		2		60		75		
Cement-Workers' Union												
Cloakmakers' Union		9	10	3 50*e*	3 00	1		9		60		
Confectioners' Union												
Coopers' Union	65	10	10	3 00	2 50				20	50		Fair
Draymen and Teamsters' Union												
Derrickmen and Engineers' Union		8		2 50*a*		2		25		75	7	Good
Engineers' Benevolent Association—Marine	35	8–12		4 00*f*						90		

TABLE No. 4—Continued.

Name of Organization.	Local Number	Number of Hours per Day's Work Required May 31, 1900, of Workers who were Members of the Organization	Number of Hours per Day's Work Required May 31, 1900, of Workers who were Not Members of the Organization	Rate of Wages per Diem May 31, 1900, of Workers in Avocation who were Members of the Organization	Rate of Wages per Diem May 31, 1900, of Workers in Avocation who were Not Members of the Organization	Decrease in Number of Hours per Day's Work Since June 1, 1896	Increase in Number of Hours per Day's Work Since June 1, 1896	Increase in Rate of Wages per Diem Since June 1, 1896	Decrease in Rate of Wages per Diem Since June 1, 1896	Number of Members Steadily Employed during Quarter Next Prior to May 31, 1900	Average Number of Days per Month of Enforced Idleness during Quarter Next Prior to May 31, 1900	Condition of Avocation Generally, as Regards Employment therein
								Pr Ct.	*Per Cent.*	*Per Cent.*		
Engineers, Amalgamated Society of		10	10	$3 00	$2 75					98		
Engineers, Brotherhood of Locomotive	161	4–16		3 50					12½	95	5	
Engineers, Brotherhood of Locomotive	283			*c*	*d*					95	0	
Engineers, Brotherhood of Locomotive	110	8–12		4 00	4 00					80		Good
Engineers, Brotherhood of Locomotive	5	10		4 35*f*						98		
Engineers, Brotherhood of Locomotive	398											
Engineers, Brotherhood of Locomotive	415											
Engineers, Brotherhood of Locomotive	425											
Engineers, Brotherhood of Locomotive	126			*c*	*d*					100		Good
Electrical Workers, International Brotherhood of	61	10	10–12	2 50	2 00			10		95		
Electrical Workers, International Brotherhood of	6	9–10	9–10	2 50	2 50					90		
Electrical Workers, International Brotherhood of	36											
Electrical Workers, International Brotherhood of	61											
Electrical Workers, International Brotherhood of	64											
Order of Railway Conductors	115	8	8	3 75*f*	3 75*f*					96		
Order of Railway Conductors	364											
Order of Railway Conductors	195											
Order of Railway Conductors	111	9	9	3 80*f*	3 80*f*					85		Fair
Order of Railway Conductors	282			4 00*f*	4 00*f*					90	2	
Firemen, Brotherhood of Locomotive	143			*c*						80		
Firemen, Brotherhood of Locomotive	260											
Firemen, Brotherhood of Locomotive	90											
Firemen, Brotherhood of Locomotive	97											
Firemen, Brotherhood of Locomotive	91			*c*	*d*							
Firemen, Brotherhood of Locomotive	58	10–13		*c*						100	0	Good

Firemen, Brotherhood of Locomotive	139	12		2 66	2 66*f*					100		
Firemen, Brotherhood of Locomotive	312											
Firemen, Brotherhood of Locomotive	314			*c*								
Firemen, Brotherhood of Locomotive	386	10–12		2 20						50		
Firemen, Brotherhood of Locomotive	327											
Brotherhood of Railroad Trainmen	198											
Brotherhood of Railroad Trainmen	71											
Brotherhood of Railroad Trainmen	73											
Brotherhood of Railroad Trainmen	74											
Brotherhood of Railroad Trainmen	278											
Brotherhood of Railroad Trainmen	340	8	8	2 60*f*	2 60*f*					100	0	Good
Brotherhood of Railroad Trainmen	420	8–10		*c*				30		90	0	
Brotherhood of Railroad Trainmen	430	10–15		*c*					25	95	6	
Brotherhood of Railroad Trainmen	458											
Order of Railroad Telegraphers	53	8–12		2 58*f*						98		
Firemen's Union (Marine)		8–9	8–9	1 66*f*	1 50*f*					90		
Glassblowers' Union												
Granite-Cutters' National Union		8		3 60						50		Good
Garment-Workers' Union												
Horseshoers' Union												
'Longshoremen's Union		9	10	3 60							15	
'Longshoremen's (S. F.) Protective Association		9	9	3 60	3 00			20		75	10	
'Longshoremen's Union												
Laborers' Protective Association		8	9–10	3 00	2 25	1				50	7	Good
Laborers and Hod-Carriers' Union												
Lathers' Union												
Lathers' Union (Wood, Wire, and Metal)												
Lithographers' Union	17	9–10	9–10	3 50*e*	3 50					100		
'Longshore Lumbermen's Protective Association		9	10	3 00	2 00							
'Longshore Lumbermen's Protective Association		10		4 00	3 00			33⅓		60		
Mantel, Grate, and Tile-Setters' Union												
Marble Cutters and Finishers' Union												
Milkers' Protective Association		12–15		1 15*f*	83	6		27		100		
Milkers' Protective Association		10	14	1 00*f*	83	4		25		95	0	
Milkers' Protective Association												
Machinists' International Association	68	10		3 50							0	Fair
Machinists' International Association	252											
Machinists' International Association	15											
Machinists' International Association	311	9–10	9–10	3 20	3 20					100		
Metal Buffers and Polishers' Union		10								80		
Metal-Roofers' Union												
Metal-Workers' Union (Amalgamated Sheet)	104	8	10	3 50	2 00					75	7	Fair
Miners' Western Federation	61	10		4 00						95	0	
Miners' Western Federation	47	10	10	2 75	2 75			10		90	0	
Miners' Western Federation	90	10		3 00						90		

TABLE No. 4—Continued.

Name of Organization.	Local Number	Number of Hours per Day's Work Required May 31, 1900, of Workers who were Members of the Organization	Number of Hours per Day's Work Required May 31, 1900, of Workers who were Not Members of the Organization	Rate of Wages per Diem May 31, 1900, of Workers in Avocation who were Members of the Organization	Rate of Wages per Diem May 31, 1900, of Workers in Avocation who were Not Members of the Organization	Decrease in Number of Hours per Day's Work Since June 1, 1896	Increase in Number of Hours per Day's Work Since June 1, 1896	Increase in Rate of Wages per Diem Since June 1, 1896	Decrease in Rate of Wages per Diem Since June 1, 1896	Number of Members Steadily Employed during Quarter Next Prior to May 31, 1900	Average Number of Days per Month of Enforced Idleness during Quarter Next Prior to May 31, 1900	Condition of Avocation Generally, as Regards Employment therein
								Pr Ct.	Per Cent.	Per Cent.		
Miners' Western Federation	70	10		$3 00	$2 00					100	0	
Miners' Western Federation	51											
Miners' Western Federation	44	8–9	8–9	3 00	3 00					81	0	
Miners' Western Federation	73											
Miners' Western Federation	39	10		3 00	3 00					75		
Musicians' Mutual Protective Union				3 00						50		
Musicians' Mutual Protective Union												
Musicians' Mutual Protective Union												
Musicians' Mutual Protective Union												
Molders' Union of America	164	10	10	3 15	3 15					90		
Molders' Union of America	199											
Molders' Union of America	164-br	8		3 30								Good
Newsboys' Union												
Newspaper-Carriers' Union, San Francisco												
Painters, Decorators, etc., Brotherhood of America	73	8		3 00						45		Bad
Painters, Decorators, etc., Brotherhood of America	131	8	8	3 50	2 75			8			10	
Painters, etc. (Sign and Picture) Brotherhood of America	132	8	9–10	3 75	2 25	1		13		25	5	
Painters, etc. (Varn. and Pol.) Brotherhood of America	134	9	10	3 00	2 50			20		70		
Painters, etc., Brotherhood of America	127	8	10	3 25	2 00			18		90		
Painters, etc., Brotherhood of America	136	8	8	3 00	2 25			20			15	
Painters, etc., Brotherhood of America	92											
Patternmakers' Union		10	10	3 50	3 35			8		50	1	
Plasterers' Union												
Plasterers' Union (Contracting)		8	8	4 00	3 00					50		Good
Plasterers' Union												

Plasterers' Association	2	8	8	4 00	2 50			33⅓		66	10	Bad
Pavers' Union (Pacific Coast)		8-9	10	4 00	2 50					60	12	Fair
Printing Pressmen's and Assistants' Union	24											
Printing Pressmen's Union	4											
Printing (Feeders and Helpers) Union	37	9	11	1 50e	1 00					85		
Printing Pressmen's Union of North America	78	9		3 50e						87		
Printing Pressmen's Union of North America	60	9		3 15						66		
Printers' Protective Fraternity	33	9		3 50						90	0	
Photo-Engravers' Union (San Francisco)		8-9		3 00	2 00					100		Good
Pile-Drivers and Bridge-Builders' Union	1	8-9	10	3 75	2 50	1		15		75	4	Good
Plumbers, Gas and Steam Fitters' Association	69											
Plumbers' Union												
Plumbers' Union												
Plumbers' Union of Alameda County		8	8	3 00	3 00	1		20		90		Good
Plumbers, Gas and Steam Fitters' Union (Journeymen)	78	8	8-10	3 00	2 25				25	65	6	
Rammers' Union												
Riggers and Stevedores' Union												
Sailors' Union of the Pacific		9-16	9-16	1 00f	83f							
Sailors' Union of the Pacific												
Sailors' Union of the Pacific												
Sailors' Union of the Pacific												
Ship and Steamboat Joiners' Union		9		4 00								
Shipwrights' Union (Journeymen)												
Shipcalkers' Association		9	10	5 00	3 50						10	
Shipjoiners' Protective Association		8	9	3 76	4 00			10		90		
Sailmakers' Union		9		4 00						100		
Scavengers' Protective Union												
Surveyors' Association (Lumber)												
Stereotypers' Union	29	8	8	3 50	3 50			8		100		Good
Stone-Cutters' Association of North America		8		4 00								
Stone-Cutters' Association of North America		8	9	4 00	2 00						10	
Tailors' Protective and Benevolent Union		10	18-20	3 50						70	3	
Tailors' Union (Ladies)												
Tailors' Union												
Tailors' Union												
Typographia Union	22											
Typographical Union	21	9		3 50	2 00					85		
Typographical Union	207	9		2 65e					11	100	⅓	Good
Typographical Union	144											
Typographical Union	174	8-9	9-10	3 50	3 00					50		
Typographical Union	223											
Typographical Union	36			3 25	1 66	1			35	50		
Typographical Union	254	9	10	2 50	1 50	1			16	90		
Typographical Union	46	9		3 15		1			10	50	15	
Typographical Union	84											

TABLE No. 4—Continued.

Name of Organization.	Local Number	Number of Hours per Day's Work Required May 31, 1900, of Workers who were Members of the Organization	Number of Hours per Day's Work Required May 31, 1900, of Workers who were Not Members of the Organization	Rate of Wages per Diem May 31, 1900, of Workers in Avocation who were Members of the Organization	Rate of Wages per Diem May 31, 1900, of Workers in Avocation who were Not Members of the Organization	Decrease in Number of Hours per Day's Work Since June 1, 1896	Increase in Number of Hours per Day's Work Since June 1, 1896	Increase in Rate of Wages per Diem Since June 1, 1896	Decrease in Rate of Wages per Diem Since June 1, 1896	Number of Members Steadily Employed during Quarter Next Prior to May 31, 1900	Average Number of Days per Month of Enforced Idleness during Quarter Next Prior to May 31, 1900	Condition of Avocation Generally, as Regards Employment therein
								Pr Ct.	Per Cent.	Per Cent.		
Typographical Union	221											
Typographical Union	56	9		$3 50						99		
Typographical Union	231											
Theatrical Employés' Protective Union	16	9		3 50						100	0	
Theatrical Employés' Protective Union	33											
Theatrical Employés' Protective Union	50									20		
Woodworkers, Amalgamated												

[a] Wages of Engineers, $4.00 per day. [b] Including board. [c] Paid by the mile. (Reduced to approximate average per day.) [d] Same as organized. [e] Paid by the week. (Reduced to average per day for sake of uniformity.) [f] Paid by the month. (Reduced to average per day for sake of uniformity.)

Table No. 4, in its tabulation of returns received regarding the general condition of avocations at the present time, in comparison with conditions prevailing in 1896, as regards decrease in hours of labor, and increase in rate of wages per diem, steadiness of employment, etc., gives information that is in the main very gratifying.

The numerous instances of increase in rate of wages as compared with instances of decrease; the numerous instances of decrease in hours of labor as compared with instances of increase; the high percentage, in most instances, of members steadily employed; the comparatively low percentage of days of enforced idleness; and the preponderance of "fair to good" over "bad" conditions reported, all make an exhibit which can be but pleasing, and which we hope may long continue without change, showing, as it does, the generally improved and prosperous condition of wage-earners in the State of California in 1900, as compared with their condition in 1896.

A further analysis of Table No. 4 reveals facts which speak with eloquence in favor of the policy of organization among those who work for wages. The uniformly fewer hours (per day's work) of workers in an avocation, who are members of the organization, as compared with the hours of workers who are not members, and the almost uniformly higher pay of those members, as compared with those who are not members, can but be convincing as regards the proposition that labor organization, properly conducted, is beneficial to the worker. Nor do the figures themselves, on their face, tell the entire story; for they do not reveal (what is known generally to those closely conversant with such matters) that the influence of labor organization, in the locality or avocation in which it exists, improves, in almost every case, the wages and condition of unorganized workers, and often in an avocation obtains for them the same benefits that accrue to organization members; and, scanning Table No. 4, it may be believed in almost every case in which unorganized workers in an avocation appear as receiving the same wages, etc., as do those organized, that it is the organization which has made better conditions for all; and that all—the unorganized as well as the organized—are receiving better wages and better treatment than would have been the case with either if organization had not been tried.

It is true that several avocations report a decrease in wages; and where this is so it will usually be found that some circumstance or condition peculiar to the particular avocation itself is the moving cause. Thus, in the case of the cigarmakers, who seem quite generally to report less wages. While Chinese labor continues to be employed in the cigar-making industry to a considerable extent, yet, by investigation made, it does not appear that the percentage of such labor thus employed has increased since 1896. As far as appears from investigation, Japanese

labor has not been, as yet, employed to any great extent in cigarmaking in the State, although some is employed in the making of cigarettes; but voluminous testimony supports the claim that the importation of Eastern-made cigars into the State has vastly increased in later years, and that the labor employed in Eastern cities in the manufacture of large quantities of such cigars is paid less for its work than are even the Chinese cigarmakers of San Francisco.

Again: The principal cause of the reduction shown in the case of the Typographical Union members is probably the increased use of linotype machines in typesetting within the last few years.

While these isolated instances of retrogression are much to be regretted so far as they affect the workers in the avocations concerned, still, conditions as a whole are generally, as noted, very gratifying.

In addition to their organization as individual lodges, and their connection as such in many cases with national central or superior bodies, many of the labor organizations of the State are members of what may be termed "local" central or superior bodies, which are in turn again connected with national central or superior bodies, and with view to securing reliable information as to such local central or superior bodies, the questions contained in Table No. 5 following, were addressed to them:

TABLE No. 5.

1. Name of central body.
2. When founded.
3. Where located.
4. Number of component organizations.
5. Name of Secretary.
6. Address of Secretary.
7. National organization affiliated with.
8. Jurisdiction of local central body, and character of organizations under its jurisdiction.
9. Basis of representation in.
10. Scope of authority over organizations represented in.
11. Remarks on scope of work, and suggestions as to legislation deemed desirable.

The data received in response to the said queries appear in Table No. 6 next following, and in remarks in connection therewith.

Table No. 6 shows name of central body, when it was founded, and location of same; number of component organizations; name and address of Corresponding Secretary, and national body affiliated with.

TABLE No. 6.

Name of Central Body.	When Founded	Where Located.	Number of Component Organizations.	Name of Secretary.	Address of Secretary.	National Organization Affiliated With.
Alameda County Federated Trades	1900	1058 Broadway, Oakland	6	C. D. Rogers	1058 Broadway, Oakland	Am. Fed. of Labor
Allied Printing Trades' Council		San Francisco		Geo. A. Orr	533 Kearny St., S. F.	
District Council of San Francisco (Carpenters and Joiners)	1894	San Francisco	6	Henry Meyer	122 Gates St., S. F.	Bro. of Car. & J. of Am.
Federated Trades' Council		Sacramento		F. E. Smith	1013 10th St., Sacramento	
Los Angeles County Council of Labor	1890	Los Angeles	17	W. M. Tomlinson	318 W. 1st St., L. Angeles	Am. Fed. of Labor
San Francisco Labor Bureau Ass'n		San Francisco		Guy Lathrop	915½ Market St., S. F.	
San Francisco Building Trades' Council	1886	915½ Market St., San Fran.	26	W. M. Page	7 Morris Ave., S. F.	
San Francisco Labor Council	1885	915½ Market St., San Fran.	35	E. Rosenberg	915½ Market St., S. F.	Am. Fed. of Labor
San Diego Federated Trades' Council	1891	San Diego	5	Harry Clark	809 Dewey St., San Diego	
Trades and Labor Council of Vallejo	1899	Vallejo	8	J. Davidson	1015 Marine St., Vallejo	Am. Fed. of Labor

By Table No. 6 it will be seen that slightly less than one half of the labor organizations of the State are members of local central bodies, as before named; 103 being thus members, as against 217 organizations. Of the central bodies named, the jurisdiction of some extends only to particular trades; and of such are the San Francisco Building Trades' Council, which includes in its membership the organizations of nearly, if not quite, all the avocations in San Francisco in any way connected with building or structural work; and the District Council of Carpenters, which includes again many of the organizations of carpenters. Central bodies such as the San Francisco Labor Council, and the Federated Trades' Councils in the several localities, include within their membership the organizations of all avocations, or nearly so, that may wish to hold such membership.

The scope of the authority of the central body over its component organizations is given, in all but one case, as advisory only. In the one case named (the San Francisco Building Trades' Council), the central body has supervisory authority over its said component organizations to the extent of passing upon all trade rules which such organizations may wish to adopt, and to employing business agents to supervise the business affairs and disputes of the central body, and of the various component organizations.

Relative to purposes of such central bodies, the mutual coöperation of wage-earners for the protection of their wages and interests is in almost every case given; and incidental thereto, the promotion of organization and unionism among the working classes.

One of the bodies named (the San Francisco Labor Bureau Association) is in the nature of a social body, and maintains club and reading rooms for its members, where they may pleasantly while away an hour in mutual interchange of ideas, or with social games, or with books, periodicals, etc.

Of the central bodies named it will be noted, again, that five are in turn members of national central bodies; and thus altogether it will appear that, starting with the individual wage-earner who is a member of a labor organization, from him to the organization of his immediate membership, from thence to the local central body, and from thence finally to the national central body, the ties of organization and brotherhood are in many cases far-reaching and closely woven.

Returns received to the request for suggestions as to legislation deemed to be desirable in behalf of wage-earners show a quite uniform agreement among the respective organizations as to matters of general importance. Summarized, and including returns received from local central bodies, we find that of the two hundred and twenty-seven distinct organizations existing in California:

One (the Journeymen Barbers' International Union) suggests the maintenance, by the State, of a Free Employment Bureau.

Four (including Barbers', Bakers', Retail Clerks', and Miners' Unions) favor the enactment of a "Sunday closing law."

One (the Cement-Workers) suggests legislation better safeguarding the fulfillment of the specifications of contracts on work.

Two (the Laborers' Union and the Federated Trades' Council of San Diego) favor legislation looking to the election of United States Senators by direct vote of the people.

One (Pile-Drivers', etc., Union) suggests giving of contracts on Government work only to the employers of union labor.

One (the Patternmakers) suggests a weekly payday law.

Four (Carpenters' Union, Iron Molders, Los Angeles County Council of Labor, and the Federated Trades' Council of San Diego) favor Government ownership of public utilities.

Two (a Carpenters' Union and an Iron Molders' Union) suggest legislation compelling arbitration in labor disputes.

One (a Milkers' Union) suggests the creation of the office of Sanitary Inspector.

One (a Telegraphers' Union) suggests legislation restraining attempts to keep wage-earners from joining labor organizations.

One (a Musicians' Union) suggests legislation prohibiting musical bands composed of persons in the employ of the Federal, State, or Municipal governments, from competing with other bands for musical work.

One (a Miners' Union) suggests legislation making the owners of mines, worked under bond or contract by third parties, responsible for the wages of employés in such mines.

One (a Miners' Union) suggests the creation of the office of Mine Inspector.

Two (both Railway labor organizations) suggest laws prescribing the number of men to be carried as crews on railway trains.

One (a Marine Engineers' Union) suggests legislation prohibiting the employment of aliens, or the importation of the same, as engineers.

One (a Retail Clerks' Association) suggests legislation requiring lady clerks to be paid not less than $10 per week.

One (a Carpenters' Union) suggests the adoption of the "initiative," "referendum," and "imperative mandate," form of legislation.

One (a Cigar-Packers' Union) suggests the prohibition of "tenement" house labor.

Two (a Cigarmakers' Union and the Alameda County Federated Trades) suggest legislation better regulating and restricting child labor in industrial avocations.

One (a Cigarmakers' Union) suggests high duties on foreign manufactured goods and free raw materials.

Two (both Railway labor organizations) suggest legislation making the employers responsible to an employé for injury received through the fault of a co-employé.

One (a Carpenters' Union) suggests legislation placing the employment agencies of the State under the jurisdiction and control of the Commissioner of the State Bureau of Labor Statistics.

Two (a Cigarmakers' Union, and a Railway Conductors' Union) suggest legislation restricting the use of the injunction process in labor difficulties.

One (a Railway labor organization) suggests legislation prohibiting "blacklisting."

Two (both Barbers' Unions) suggest the passage of laws providing for a standard of efficiency, and for examination as to such efficiency, on the part of workers in the trade.

Three (a Brotherhood of Carpenters' Union, the Alameda County Federated Trades, and the San Francisco Building Trades Council) suggest legislation prohibiting the competition of convict or "unfair" labor with free labor.

Two (both Cigarmakers' Unions) suggest the prohibition, by legislation, of union labels on goods manufactured by unorganized labor.

Two (a Stone-Cutters' Union, and a Carpenters' Union) suggest the prohibition, by legislation, of the doing of public work by contract.

Two (both Typographical Unions) suggest legislation requiring the use of the union label on all Government and State printing.

Seven (including two Bakers' Unions, one Cigarmakers' Union, an Amalgamated Engineers' Union, a Metal Polishers and Buffers' Union, and a Paperhangers' Union) suggest legislation looking to the improvement of sanitary conditions around workshops and places of employment.

Seven (including three Cigarmakers' Unions, one Laborers' Union, one 'Longshore Lumbermen's Union, one Miners' Union, and one Typographical Union) suggest legislation prohibiting the incoming of Chinese and Japanese labor.

Seven (including three Carpenters' Unions, a Cement-Workers' Union, a Printers' Union, a Plasterers' Union, and the San Francisco Building Trades' Council) suggest legislative improvement of the mechanics' lien laws of the State.

Two (a Typographical Union and a Molders' Union) suggest legislation regulating the apprenticeship of boys to trades.

The Sailors' Union suggests legislation providing for a legal working day of nine hours (applicable only to sailors in port, as I understand it); a standard of efficiency in seamanship; the number of seamen each vessel must carry, based on the tonnage of the vessel; freedom of sea-

men to quit work in foreign as well as in home ports; for the repeal of Sections 644 and 645 of the Penal Code of California.

One organization (the San Francisco Building Trades' Council) suggests the legislative abolition of private employment agencies.

One organization (the Federated Trades of San Diego County) suggests the legislative inauguration of postal savings banks.

Thirty organizations (including a Bakers' Union, two Carpenters' Unions, two Cigarmakers' Unions, one Coopers' Union, one Engineers' Union, one Electrical-Workers' Union, one Marine Firemen's Union, one Iron-Molders' Union, one Lithographers' Union, one Mill-Workers' Union, one Machinists' Union, two Miners' Unions, one Patternmakers' Union, one Pavers' Union, one Pile-Drivers and Bridge-Builders' Union, two Sailors' Unions, one Stair-Builders' Union, one Stone-Cutters' Union, one Typographical Union, one Waiters' Union, the Alameda County Federated Trades, the Los Angeles County Council of Labor, the Federated Trades and Labor Council of San Diego County, the Trades and Labor Council of Vallejo, and the San Francisco Building Trades' Council) suggest the enactment of legislation shortening the hours of daily labor generally, and, in most cases, name eight hours per day as the suggested maximum limit for a day's work.

Certainly, the variety of subjects here suggested as proper for legislative attention gives wide scope for thought and mental effort on the part of our lawmakers.

Next following is Table No. 7, which shows organizations grouped according to year when founded, so far as answers received contain such data:

TABLE No. 7.

Name of Organization.	Local No.	Year When Founded.
Amalgamated Society of Engineers		1850
Shipcalkers' Association		1853
Ship and Steamboat Joiners' Union		1857
Typographical Union	46	1859
Granite-Cutters' Union		1862
Molders' Union	164	1867
Laborers' Protective Association		1868
Brotherhood of Locomotive Engineers	110	1869
Typographical Union	21	1872
Brotherhood of Locomotive Firemen	314	1873
Tailors' Protective and Benevolent Union (Journeymen)		1873
Bookbinders' Protective and Benevolent Association		1875
Typographical Union	174	1875
Brotherhood of Locomotive Engineers	126	1876
Miners' Western Federation	61	1877
Brotherhood of Locomotive Engineers	5	1878
Pavers' Union (Pacific Coast)		1878
Bakers' Union	37	1880
Order of Railway Conductors	282	1880
Brotherhood of Locomotive Firemen	386	1881
Bricklayers' Union		1882
U. B. C. and J. of America	22	1882
Coopers' Union		1882
Marine Engineers' Benevolent Association		1882
U. B. C. and J. of America	35	1883

TABLE No. 7—Continued.

Name of Organization.	Local No.	Year When Founded.
Brotherhood of Locomotive Firemen	143	1883
Sailmakers' Union	------------	1883
Brotherhood of Railroad Trainmen	430	1883
Order of Railway Conductors	115	1884
Order of Railway Conductors	111	1884
Machinists' International Association	68	1884
Journeymen Bakers' Union	24	1885
Cigarmakers' Union	225	1885
Cigarmakers' Union	228	1885
Brotherhood of Locomotive Engineers	283	1885
Marine Firemen's Union	------------	1885
Musicians' Mutual Protective Union	------------	1885
Brotherhood of Railroad Trainmen	198	1885
Typographical Union	56	1885
Sailors' Union of the Pacific	------------	1885
Sailors' Union of the Pacific	------------	1885
U. B. C. and J. of America	235	1885
National Union of Brewery Workmen	7	1886
Cigarmakers' Union	238	1886
Cigarmakers' Union	291	1886
Cigarmakers' Union	253	1886
Printing Pressmen's Union of North America	60	1886
Sailors' Union of the Pacific	------------	1886
Order of Railroad Telegraphers	53	1886
Typographical Union	207	1886
Typographical Union	36	1886
U. B. C. and J. of America	304	1887
U. B. C. and J. of America	316	1887
'Longshoremen's Union	------------	1887
Patternmakers' Union	------------	1887
Sailors' Union of the Pacific	------------	1887
Stonecutters' Association of North America	------------	1888
Stonecutters' Association of North America	------------	1888
Bakers' Union	85	1889
Bricklayers' Union	------------	1889
U. B. C. and J. of America	483	1889
Typographical Union	254	1889
Printers' Protective Fraternity	33	1890
Brotherhood of Railroad Trainmen	340	1890
Cigarmakers' Union	332	1891
U. B. C. and J. of America	332	1892
Plumbers, Gas and Steam Fitters' (Journeymen)	78	1892
International Brotherhood of Electrical Workers	61	1893
Miners' Western Federation	90	1894
Metal Workers' Union, Amalgamated Sheet	104	1894
Theatrical Employés' Protective Union	16	1894
Boilermakers' Brotherhood of America	148	1895
U. B. C. and J. of America	36	1895
International Brotherhood of Electrical Workers	6	1895
Brotherhood of Locomotive Firemen	58	1895
Milkers' Protective Association	------------	1895
Miners' Western Federation	70	1895
Lithographers' Union	17	1895
U. B. C. and J. of America	95	1896
Painters, Decorators, etc., Brotherhood of America	134	1896
Printing Pressmen's Union of North America	78	1896
Bookbinders' Union	63	1897
Branch Union of Brewery Workmen	3	1897
Miners' Western Federation	44	1897
Printing (Feeders and Helpers) Union of North America	37	1897
Stereotypers' Union	29	1897
Theatrical Employés' Protective Union	50	1897
Pacific Coast Waiters' Association	------------	1897
U. B. C. and J. of America	194	1898
Photo-Engravers' Union (San Francisco)	------------	1898
Bottlers' Union	102	1899
U. B. C. and J. of America	426	1899
U. B. C. and J. of America	423	1899
U. B. C. and J. of America	162	1899
Cement-Workers' Union	------------	1899

TABLE No. 7—Continued.

Name of Organization.	Local No.	Year When Founded.
Cloakmakers' Union		1899
Clerks' International Protective Association	373	1899
Derrickmen and Engineers' Union		1899
'Longshore Lumbermen's Protective Association		1899
'Longshoremen's (San Francisco) Protective Association		1899
'Longshore Lumbermen's Protective Association		1899
Miners' Western Federation	47	1899
Milkers' Protective Association		1899
Metal Buffers and Polishers' Union		1899
Plasterers' Union (Contracting)		1899
Pile-Drivers and Bridge-Builders' Union	1	1899
Painters, Decorators, etc., Brotherhood of America	73	1899
Painters, Paperhangers, and Frescoers' Brotherhood of America	131	1899
Painters' Brotherhood of America	127	1899
Plasterers' International Association	2	1899
U. B. C. and J. of America	16	1899
Plumbers' Union of Alameda County		1899
Shinglers' Union		1899
Shipjoiners' Protective Association		1899
Brotherhood of Railroad Trainmen	420	1899
Barbers' Union	148	1900
French Bakers' Union		1900
Barbers' International Union	134	1900
Branch Union of Brewery Workmen	2	1900
U. B. C. and J. of America	550	1900
U. B. C. and J. of America	586	1900
Machinists' International Association	311	1900
Miners' Western Federation	39	1900
Painters' (Sign and Picture) Brotherhood of America	132	1900
Painters' Brotherhood of America	136	1900

We have no source of knowledge of the organizations which may, respectively, from time to time, have come into existence in California since the inception of labor organization therein, only to flourish but for a while, and then to die and drift to oblivion with the tide of time. Doubtless they are many, but regarding them we do not know. Of organizations now existing (217, as before noted, not including local central bodies), 125 gave, in their returns, the year in which they respectively were founded, with results as appear in the foregoing table (No. 7).

By said table it is shown that in the procession of the labor organizations in question, marshaled according to the years of their respective inceptions, the *Amalgamated Society of Engineers* carries the *pioneer flag*, the year of its foundation being 1850, being thus as old as the State of California itself. Close behind it treads the Shipcalkers' Association, founded in 1853; the Ship and Steamboat Joiners' Union, founded in 1857; and Typographical Union No. 46 (of Sacramento), the Granite-Cutters' Union, and others in later line.

The founders of these first organizations were doubly pioneers. They were pioneers of the State as well as of the labor organization movement within it. Doubtless the most of them, with other argonauts of the Golden Age, have passed to the great majority; but the State which

they helped to found has become great among the States of the Union, and the organizations whose foundations they so well fashioned still live as monuments to them in the industrial world.

In Table No. 7 (and noting, in passing, the increase more or less in extent from the beginning) we can but note the remarkable increase in organization of labor manifest since the commencement of the year 1899. While prior to said time not more than eight or ten organizations have come into existence in any one year, and while the rule has been not more than four or five, we find the record for 1899 to have suddenly increased to twenty-five, while ten new organizations appear during the first half of the present year, 1900. Viewing these facts, and recalling statements and rumors so generally current regarding increase in the number of combinations of Capital within about the same time, it is logical to conclude that there is sympathy or connection between the principles and conditions which justify and make possible combinations of Capital, and those which justify and make possible combinations of Labor, and doubtless it is so. The combination in both cases proceeds from the same moving cause; that is to say, humanity at all times, in all ways, and in all places strives to do that which it believes will most benefit itself and its own interests; and in so doing must ever do battle with nature's law of the "survival of the fittest"; and in that battle he who takes not his own part takes not at all. Organization and coöperation is one of the first impulses of human nature. In every walk in life, those mutually interested in the attainment of any given object follow this impulse, and unite their efforts in futherance of the common benefit, and in such union there is strength, while in individual effort there is but weakness. But what shall be thought of the equity of him who, in any case, claims for himself and for his interests this right of union, and denies it to his opponent? He, indeed, would make the law of "might," and not the law of justice, supreme.

Why, then, should Labor not combine, or why should Capital not combine, for the protection of their respective interests? The wrong which comes from the combination of either Labor or Capital in any case, comes not from the principle or from the fact of combination itself, but from misuse, sometimes, of the power which combination gives, and in this there is no difference in principle between the act of an individual and the act of a combination; and the logic which would say that because some combination may at some time do something wrong, all combinations are evil, and should be suppressed and prohibited, is as little forceful as would be logic saying that some individual may at some time commit murder, and that therefore all individuals are evil and should be exterminated.

Attention has somewhere been aptly called to the fact that what are termed "questions between Capital and Labor" are often referred to as

though based upon, or containing, some peculiar, mysterious principle. They, in fact, contain nothing of the kind. They arise in all cases upon exactly the same premises as do questions between buyers and sellers of any other degree or place; they are properly governed only by the same business rules and the same common sense that should govern questions regarding the conduct of business affairs between men in any other walks of life. In speaking of business rules and common sense in this connection, we may as well frankly lay bare and acknowledge the fact that only in the contemplation of theorists do men in business affairs, whatever may be the place, station, or condition of the respective parties, give more, or exact less, than the conditions under which they respectively act, compel or permit them to. The end and aim of the employer in any enterprise is self-benefit, not philanthropy, in conducting the same. The end and aim of the wage-earner whom he employs is self-benefit, and not philanthropy. Thus, in motive for their dealing with each other they stand upon equality. Incidentally, the action of each may bring benefit to the other, but benefit to the other is not the motive for action in either case. The end and aim of capitalistic combination is benefit to the investments of Capital, and not injury to Labor; and the creed often fostered by demagogues, that such end and aim is to grind down and crush Labor, is not worthy of attention. The end and aim of combinations of wage-earners is benefit to wage-earners, not injury to Capital nor to employers; and the creed often fostered by those hostile to labor organizations, that combinations of Labor are baneful institutions, whose ends and aims are anarchistic, and seek the destruction of the rights of property, is again puerile. The moving thought of either combination is simply benefit, or what it is deemed will be benefit, to its members. Incidentally may come with either of the combinations named injury to the interests of the other, or to the interests of others; but if methods be within the law, who shall be heard to complain if perchance, in such case, the worker's gain is another's loss?

The deductions, here following, are:

(1) That there is nothing wrong or illegal in combinations of either Labor or Capital, further than their methods may make wrong, and that in this they stand upon no plane other than that upon which individuals stand.

(2) That in the matter of motive for combination they stand before each other and before the world upon equality.

(3) That in working for their ends, there may arise, incidentally, good or evil to the other, or to others, from the acts of each.

Increase in wages, made possible by combinations of wage-earners, may reduce the profits of employers, or increase the price of commodities to those who consume.

Increase in profit, made possible by combinations of Capital, may make less, in some cases, the wage or wages of wage-earners, or increase the price of commodities to consumers.

But once again, if methods are within the law, who in either case shall be heard to complain, or to say to the wage-earner that he may not take his own part?

And another conclusion here becomes apropos, and that is that standing upon equality as named, as do combinations of Labor and combinations of Capital, any legislation directed to the restriction or prohibition of one, must, if equally and consistently enforced, work the restriction or prohibition of the other also. And this explains the coldness with which wage-earners have, as a rule, received "anti-trust" legislation.

Standing thus upon equality as to right of existence, as to motive for existence, and as to method, why should not the representative of Organized Labor and of Organized Capital meet upon all questions between Labor and Capital in the respective employments and avocations, and, in what has been happily termed "a spirit of enlightened selfishness," each zealous in protection of their respective interests, with sound business and common sense adjust them?

A vast amount has been written relative to the evil from time to time resulting to Labor, and to other interests, from the "strikes" of labor organizations. Columns of figures have been presented purporting to show the millions of dollars lost, beyond recall, in wages to workingmen, through the medium of such strikes. It is hackneyed to say that strikes should only be resorted to in the settlement of difficulties when all other lawful methods have failed. It is, or should be, elementary in labor-organization learning, to say that strikes should never be declared except under the dictates of the soundest business prudence and common sense; but with this premise, a great deal which is written and said about the evil of strikes is written and said without appreciation of the principle which underlies the strike. A strike, properly conducted, is nothing more nor less than the exercise of the worker's right, either individually or in combination with his fellow, to refuse to sell his labor when the conditions and prices offered to him in exchange therefor are unsatisfactory. And in this he follows no other principle than is followed by his employer, who, on occasion, refuses to sell to a would-be purchaser the commodity which he manufactures, because the conditions and prices offered him in exchange therefor are unsatisfactory. It is true that the worker who "strikes" often suffers, but it is true again that his suffering oftentimes makes smoother and better the path of the worker who comes after him. None, speaking frankly, can gainsay the fact that the wages of Labor, and the condition of Labor, as employed to-day are better for the fact that in the past there have been Labor strikes. The soldier who goes to battle too

often receives but wounds and death as his portion, but his martyrdom makes the way for Liberty after. To send the worker forth into the industrial world, deprived of his privilege to "strike," to battle for his part, would be tantamount to sending the soldier forth to war, deprived of weapons. The very knowledge that such weapon is within reach often brings prestige to the wage-earner in seeking right, which otherwise he would not have.

In speaking here of strikes, we speak of them in connection only with what they properly include, viz: the right peaceably to quit work when wages and conditions are unsatisfactory. The labor organization stands upon equality with all other factors within the commonwealth. In the furtherance and protection of the interests of its members, it may rightfully go as far as any other combination or individual may legally go; whatever is legal in method for others to do in self-advancement or self-protection it may rightfully do; it may do no more. Whenever it reaches the line which divides between lawful and unlawful acts, the true friends of labor organization always counsel pause; whenever it crosses that line the true friends of labor organization always in no uncertain way condemn. It may perchance at times be, that in the excitement of disputes between Labor and Capital, an organization, incited and led by the waving of demagogic firebrands, may be tempted to cross the line to deeds of violence, which can but injure the name of Organized Labor, and do lasting harm to its cause; but true wisdom in the interests of wage-workers in general will always in such cases restrain and point to the fact that in all the history of Labor strikes the beginning of violence, as a rule, marks the beginning of the downfall of the cause; counseling the while that a lesser gain to-day, legally obtained, makes surer the foundation for to-morrow.

It may not be out of place here to suggest, that perhaps Organized Labor has not yet been given the place and dignity which it deserves as a social and economic factor, even by its friends and public champions, or those assuming to be such; that it receives in the public mind too often but captious recognition; that at times it is held too little accountable for wrongful acts or methods; at times too fulsomely lauded, at times too readily condemned; when "down," too often finds "none so poor to do it reverence"; is received with toleration when it should be received of right; is refused recognition when fair and open recognition should be given, and is belittled and condemned when it should be encouraged and supported.

Continuing the subject of strikes, consideration shows that there are two industrial conditions that are prolific of strikes, viz: industrial depression and industrial prosperity. We can recall how, during the dark days of four or five years ago, labor difficulties and strikes existed in almost every direction. Loaded with the evil of failing or disappearing profits, the

employer sought to shift from his own shoulders, to those of the worker, the burden, or a portion of it. Naturally averse to being thus called upon to assist in bearing the load, the worker strenuously resisted, even to the extent, in many cases, of "striking." During the past two years of prosperity labor difficulties and strikes have again occurred in many places; resulting, however, from inverse causes, that is to say: During the said two past years, invested Capital has prospered. Profits have increased, and the worker has come to the employer and demanded a share of the increase. Averse to parting with such share, the employer has refused, and the worker in many cases has strenuously insisted that his demand be granted, even to the extent, in some cases, of "striking." There is a notable distinction, however, between the strike of 1895 and the strike of 1900; and it is, that where, in the former time, the worker, as a rule, was unsuccessful, in the latter time success has usually been his portion. But in either time the history of the strikes makes not all the story of the change in the condition of the workers, since, in the former time, many a reduction of wages and increase in hours of labor were received by the worker in despairing submission, while in the latter time increase in wages has been granted, and shorter hours of labor have been obtained, with little or no controversy, upon the mere requests of the workers, and as the result of peaceable and friendly negotiation with employers.

In the matter of strikes it is pleasing to note that while Labor has made material gains in many cases in the way of increase in wages and in the betterment of conditions during the past two years, strikes in this State during that time have been comparatively few. Those occurring have, in most cases, been of small magnitude, and of short duration. Data at hand on this subject are not complete, but of the more important strikes within the time last named may be mentioned that of the Cloakmakers' Union in San Francisco, which resulted from the action of several of the cloakmaking firms in locking out those of their employés who were members of the union; and the strike of the Mill-Workers' Union of San Francisco, and of Alameda County (supported by the Building Trades Council of the respective places named), which resulted from a refusal on the part of the mill-owners to grant a request of the mill-workers that the number of hours required of them for a day's work be reduced from ten and nine, to eight.

In the case of the former strike partial success has thus far attended the efforts of the union; one of the three firms originally concerned in the controversy having withdrawn its opposition to union members. As regards the other firms, the strike is being continued at this writing.

As regards the strike of the mill-workers, and avoiding an attempt at discussion of the merits of the controversy at this time, further than to say that the mill-worker certainly seems not unreasonable, in view of

the general betterment of trade conditions of all kinds, in asking for a share in that betterment, there is one thing in connection with it which speaks eloquently in favor of the mill-workers, and which causes all fair-minded persons to hope for their ultimate success, and that is, the legitimate, open, and fair manner in which their strike has been conducted. Both in San Francisco and in Alameda County, during an already protracted contest, good judgment and good generalship have marked the handling of their cause. There has been no lawlessness, there has been no disorder; they have gone about the matter like business men, seeking in a business way to settle a business difference with the employers. In attempted furtherance of their ends they have exercised their right, collectively, to quit work; they have been at all times ready to meet the employers in amicable and peaceful discussion of differences; and altogether have set an example of a strike, fairly and properly conducted by intelligent wage-earners, of which the people of California may well be proud, especially in view of the disorderly and illegal acts which have too frequently attended strikes in other States. In view of the good sense and good judgment displayed in the conduct of their cause, aside from other reasons, it is to to be hoped that ultimately the mill-workers will secure a settlement satisfactory to themselves in their controversy.

Reverting to the subject of labor organization in general, and to the refusal of fair recognition of it at times, as before named, an almost "stock" assertion on the part of employers and others opposed to organized labor is, that they "do not propose to be dictated to as to how they shall conduct their business affairs." It is not to be denied that organizations of labor may, and perhaps at times do, seek to discuss with employers subjects which are properly within the sole discretion of the employers, and such attempts should be frankly discouraged by the friends of Organized Labor; but surely the above-named objection to attempted "dictation" cannot properly be heard as regards questions pertaining to wages, hours of labor per day, or conditions of employment. These all are questions in which the worker himself properly has voice, either personally or through his chosen representative. If, as to the settlement of such questions, the worker deems that his interests will be best protected by combination with his fellow-workers, and by speaking and acting through representatives rather than in person, by what rule of justice shall any one be heard to deny his right so to do? The point is persistently made here that the worker stands upon equality with all others in the commonwealth; that he has a legal and equitable right to be heard in the same way and by the same methods in and by which others make themselves heard. We have in this State at the present time a Prune-Growers' Association. It is a perfectly legitimate combination, formed to protect and advance the

interests of the growers of prunes. We have something similar as regards the raisin-makers of the State. In the case of the representatives of either combination, in conference with would-be buyers of prunes or raisins, he would be regarded as imbecile who would suggest that the price of the product, the whole quantity to be delivered, or the quantity to be delivered per diem, or the place of delivery, should not be discussed, because such discussion would be in effect an attempt on the part of the seller to dictate to the buyer as to how said buyer should conduct his business affairs.

Again, attempts on the part of representatives of labor organizations to adjust differences between members of the organization and their employers, are often met with the assertion on the part of employers that "it is not proposed to allow 'outsiders' to interfere." Wherein is this more consistent than would be a refusal on the part of the would-be buyer of a commodity to negotiate with the representative put forward by the seller, on the ground that he (the buyer) did not propose to deal with an outsider? In his dealing with the employer of to-day, in how many cases does the employé deal with the principal? In this age of combination, how far the cry often from the worker to the owner? The complaint here is not against the combination. That, perhaps, is an adjunct of the progress and the civilization of the century. The prayer is not for pity for the worker, but only for equality and a "fair field"; the right to use in the industrial battle the same methods and the same weapons in self-protection and in self-advancement that his opponents use against him. Public opinion should support him at all times in his demand for this equality and for this fairness, and should hold him to strict accountability for misuse of power and for wrongful acts and methods.

It may not be out of place here to make mention of that much-maligned and misrepresented incident of Organized Labor, the "walking delegate." According to popular representation, the walking delegate is an individual of remarkably vicious propensities, who by some occult process subjugates the worker to his will, and with despotic wave of the hand causes him to "strike," often and long, much against his (the worker's) inclination. A genuine article of "walking delegate" (according to the popular representation named) is always recognizable by a large diamond (imitation or otherwise) affixed to his shirt front. Now, as a matter of fact, "the river never rises above its source," and "by its fruits we know the tree." The representative of the organization is a creation of the organization itself, and of its rules, and if not in acts and policies in accord with the ideas of a majority of the members, and if not obedient to the rules which the members themselves make for his government, will not long survive. The regulation which gives to the representative authority to tell men when to strike, is one formulated

and consented to by the men themselves beforehand. The "walking delegate" only executes laws for the organization and its members, he does not make them; he is simply a representative, and stands, in relation to the organization, in no great degree different from the manner in which the representatives of capitalistic and other combinations stand in relation to those whom they represent.

Once more to the proposition that Organized Labor should be given a more dignified and stable place in the economy of the commonwealth than has hitherto been accorded it. Why should not this be so? Why should it not be encouraged and supported by public opinion at all times when right, and condemned when wrong, the same as any other factor in society is or should be? Why should it not then be looked to in greater degree than now as the medium through which the interests of wage-earners generally may find that protection and advancement which none deny they should have? Why should it not then be the medium through which the wage-earner may take his own part in an upright, manly way in the battle of interests that is continually waged in the economic world? Why not thus take his own part, not in a spirit of carping discontent; not with a feeling that the world is all against him because, perchance, he must contest with others for his portion; but in that spirit of "selfish enlightenment" before named, claiming his fair share, and striving for it.

Thus meeting his employer and his employer meeting him, in mutual fairness of spirit, each safeguarding his own interests with sound reason and common sense, the mystery of questions between Labor and Capital would disappear. Labor would refrain from imposing prices and conditions which would stifle demand for its product, and thus would avoid self-injury. Capital would avoid decrease of wages wherever possible, recognizing that upon the purchasing power of the wage-earners of the nation rests ultimately the prosperity of all, invested Capital included, and that whenever such power is lessened invested Capital suffers.

In another part of this report, attention is called to the fact that as to the condition of the wage-earner generally, California leads the States of the United States, and the United States leads the countries of the earth. Great has been the progress of the worker. From the barbarian of the remotely dim age of the beginning, ministering but to his savage wants; from the abject slave of later time, whipped to his toil without reward; from the groveling vassal of but a century or two ago, he has come onward and upward to his place of to-day. In all his progress, intelligent organization has been a helping factor of untold importance; and standing now, looking into the dawn of a new century, "Onward and Upward" still his watchwords, he who preaches to him "despair" is not his friend. He who cries that his course is downward, turns his face from facts. Could it be believed that after this struggle

of centuries the set of the tide is still sweeping him backward; that his efforts for betterment of even the last half century have left him further behind on the path of progress than he was at the beginning, as so many of his woful well-wishers would teach him to believe, then indeed might it be felt that all future effort for betterment on his part could have only disappointing end. But there has been great progress in the past, and there will be progress still in the future. Each year and each effort will make something better than it was before, and labor organization will in the future hold the place which its importance as a factor in the industrial world entitles it to hold.

FINANCIAL STATEMENT

For the Fifty-first Fiscal Year Ending June 30, 1900.

APPROPRIATIONS.

Salary of Commissioner		$3,000 00
Salary of Deputy Commissioner		1,800 00
Salaries of Special Agents, and traveling and contingent expenses		2,500 00
Printing		875 00
Office rent		600 00
		$8,775 00

DISBURSEMENTS.

Salary of Commissioner	$3,000 00	
Salary of Deputy Commissioner	1,800 00	
Salaries of Special Agents	1,986 21	
		$6,786 21
Printing		89 25
Office rent		600 00
Traveling expenses		51 20
Contingent expenses		273 74
		$7,800 40
Total appropriations	$8,775 00	
Total disbursements	7,800 40	
Unexpended balance June 30, 1900	$974 60	

SALARY ACCOUNT ITEMIZED.

E. L. Fitzgerald, Commissioner, July 1 to Sept. 7, 1899, at $250 per month	$550 00
F. V. Meyers, Commissioner, Sept. 7, 1899, to July 1, 1900, at $250 per month	2,450 00
C. L. Dam, Deputy Commissioner, July 1 to Oct. 5, 1899, at $150 per month	470 00
J. D. Kelsey, Deputy Commissioner, October 5, 1899, to February 1, 1900, and from February 12 to July 1, 1900, at $150 per month	1,271 15
E. L. Reguin, Deputy Commissioner, February 1 to February 12, 1900, at $150 per month	58 85
"Extra" help, named by Commissioner Fitzgerald as employed during July, 1899	25 00
T. E. Nelson, Special Agent, July 1 to October 1, 1899, at $100 per month, and from October 1 to November 1, 1899, at $60 per month	360 00
E. L. Brackett, Special Agent, July 1 to September 8, 1899, at $100 per month	226 80
E. L. Reguin, Special Agent, October 14, 1899, to February 1, 1900, and from February 12 to July 1, 1900, at $100 per month	820 69
K. Zwicker, Special Agent, November 17, 1899, to July 1, 1900, at $60 per month	448 00
W. Macarthur, Special Agent, May 24 to June 24, 1900 (inclusive), at $100 per month	105 72
	$6,786 21

PRINTING ACCOUNT ITEMIZED.

Oct. 24, 1899—From State Printing Office, 5,000 letterheads; 2,500 No. 6 and 2,500 No. 9 envelopes	$48 75
May 28, 1900—From State Printing Office, 5,000 letterheads; 3,000 No. 6 and 2,000 No. 9 envelopes	40 50
	$89 25

OFFICE RENT ACCOUNT ITEMIZED.

Rent from July 1, 1899, to July 1, 1900, 12 months, at $50 per month	$600 00

TRAVELING EXPENSE ACCOUNT ITEMIZED.

1899—Nov. 27—F. V. Meyers, railroad fare, San Francisco to Healdsburg and return	$4 50
1900—June 21—F. V. Meyers, 1,000-mile railway mileage ticket, for traveling account of Bureau	25 00
Feb. 20—E. L. Reguin, Special Agent, car and railroad fare since January 20, 1900	3 70
Mar. 20—E. L. Reguin, Special Agent, car and railroad fare since February 20, 1900	2 85
Apr. 20—E. L. Reguin, Special Agent, car and railroad fare since March 20, 1900	2 25
May 20—E. L. Reguin, Special Agent, car and railroad fare since April 20, 1900	4 60
June 30—E. L. Reguin, Special Agent, car and railroad fare since May 20, 1900	8 30
	$51 20

CONTINGENT EXPENSE ACCOUNT ITEMIZED.

Telephone	$133 55
Postage	57 00
Stationery	50 84
Expressman's charges	9 56
Electric office bells	8 50
Mercantile Towel Company (office towels)	8 25
Cleaning office carpets	3 84
Sign-lettering on office door	2 50
	$273 74

A law of this State requires the official head of any State institution, for which State money, other than for salaries, is appropriated, to submit a detailed statement of the manner in which all money appropriated, as said, for the respective institution, has been expended, and in accordance therewith the foregoing statement is submitted, covering the fifty-first fiscal year.

It will be noted therein that of the appropriations made for salary of Commissioner, salary of Deputy Commissioner, and for office rent, for the fiscal year in question, the full amount has been expended.

For salaries of Special Agents, and for traveling and contingent expenses, an appropriation of $5,000 was made by the Legislature to cover such expenses, etc., for the fifty-first and fifty-second fiscal years; and by law it is provided that not more than one half of such appropriation shall be expended during the fifty-first fiscal year. Of such one half, it will be seen that there remained, July 1, 1900, an unexpended balance of $188.85, which is available, in connection with the last half of said appropriation of $5,000, for the use of the Bureau during the fifty-second fiscal year.

It will be noted, again, that the statement shows an unexpended balance of $785.75 in the appropriation for printing. The law requires the Bureau to have all of its printing done at the State Printing Office, and the Legislature appropriated $1,750 to cover the expense of all printing required by the Bureau during the fifty-first and fifty-second fiscal years. For purposes of computation, one half of the said $1,750, or $875, was, in the foregoing statement, credited to the fifty-first fiscal year. Now, however, the expense of printing the Biennial Report of the Bureau must come from the said appropriation of $1,750. The probable cost of such printing will be about $1,500; hence it is seen that by the time the said statement is published, there will remain in the printing fund of the Bureau no more than enough to meet the expense of the ordinary printing of the Bureau during the remainder of the fifty-second fiscal year.

LABOR LAWS

OF THE

STATE OF CALIFORNIA.

LABOR LAWS OF THE STATE OF CALIFORNIA.

Board of Arbitration and Conciliation.

(Stats. of Cal. 1891, p. 49.)

SECTION 1. On or before the first day of May of each year, the Governor of the State shall appoint three competent persons to serve as a State Board of Arbitration and Conciliation. One shall represent the employers of labor, one shall represent labor employés, and the third member shall represent neither, and shall be chairman of the board. They shall hold office for one year and until their successors are appointed and qualified. If a vacancy occurs, as soon as possible thereafter the Governor shall appoint some one to serve the unexpired term; *provided, however*, that when the parties to any controversy or difference, as provided in section two of this Act, do not desire to submit their controversy to the State board, they may by agreement each choose one person, and the two shall choose a third, who shall be chairman and umpire, and the three shall constitute a Board of Arbitration and Conciliation for the special controversy submitted to it, and shall for that purpose have the same powers as the State board. The members of the said board or boards, before entering upon the duties of their office, shall be sworn to faithfully discharge the duties thereof. They shall adopt such rules of procedure as they may deem best to carry out the provisions of this Act.

SEC. 2. Whenever any controversy or difference exists between an employer, whether an individual, co-partnership, or corporation, which, if not arbitrated, would involve a strike or lockout, and his employés, the board shall, upon application, as hereinafter provided, and as soon as practicable thereafter, visit, if necessary, the locality of the dispute and make careful inquiry into the cause thereof, hear all persons interested therein who may come before them, advise the respective parties what, if anything, ought to be done or submitted to by either, or both, to adjust said dispute, and make a written decision thereof. This decision shall at once be made public, and shall be recorded upon proper books of record to be kept by the board.

SEC. 3. Said application shall be signed by said employer, or by a majority of his employés in the department of the business in which the controversy or difference exists, or their duly authorized agent, or by both parties, and shall contain a concise statement of the grievances complained of, and a promise to continue on in business or at work,

without any lockout or strike, until the decision of said board, which must, if possible, be made within three weeks of the date of filing the application. Immediately upon receipt of said application, the chairman of said board shall cause public notice to be given of the time and place for hearing. Should the petitioners fail to keep the promise made therein, the board shall proceed no further thereupon without the written consent of the adverse party. And the party violating the contract shall pay the extra cost of the board entailed thereby. The board may then reopen the case and proceed to the final arbitration thereof as provided in section two hereof.

Sec. 4. The decision rendered by the board shall be binding upon the parties who join in the application for six months, or until either party has given the other a written notice of his intention not to be further bound by the conditions thereof after the expiration of sixty days or any time agreed upon by the parties, which agreement shall be entered as a part of the decision. Said notice may be given to the employés by posting a notice thereof in three conspicuous places in the shop or factory where they work.

Sec. 5. Both employers and employés shall have the right at any time to submit to the board complaints or grievances, and ask for an investigation thereof. The board shall decide whether the complaint is entitled to a public investigation, and if they decide in the affirmative, they shall proceed to hear testimony, after giving notice to all parties concerned, and publish the result of their investigations as soon as possible thereafter.

Sec. 6. The arbitrators hereby created shall be paid five dollars per day for each day of actual service, and also their necessary traveling and other expenses incident to the duties of their office shall be paid out of the State treasury; but the expenses and salaries hereby authorized shall not exceed the sum of twenty-five hundred dollars for the two years.

Bureau of Labor Statistics.

(Stats. of Cal. 1883, p. 6. As amended, Stats. of Cal. 1889, p. 8.)

Section 1. As soon as possible after the passage of this Act, and four years hereafter, the Governor of the State shall appoint a suitable person to act as Commissioner of a Bureau of Labor Statistics. The headquarters of said Bureau shall be located in the City and County of San Francisco; said Commissioner to serve for four years, and until his successor is appointed and qualified.

* * * * * * * *

Sec. 3. The duties of the Commissioner shall be to collect, assort, systematize, and present in biennial reports to the Legislature statistical

details relating to all departments of labor in the State, such as the hours and wages of labor, cost of living, amount of labor required, estimated number of persons depending upon daily labor for their support, the probable chances of all being employed, the operation of labor-saving machinery in its relation to hand labor, etc. Said statistics may be classified as follows:

1. In agriculture;
2. In mechanical and manufacturing industries;
3. In mining;
4. In transportation on land and water;
5. In clerical and all other skilled and unskilled labor not above enumerated;
6. The amount of cash capital invested in lands, buildings, machinery, material, and means of production and distribution generally;
7. The number, age, sex, and conditions of persons employed; the nature of their employment; the extent to which the apprenticeship system prevails in the various skilled industries; the number of hours of labor per day; the average length of time employed per annum, and the net wages received in each of the industries and employments enumerated;
8. The number and condition of the unemployed, their age, sex, and nationality, together with the causes of their idleness;
9. The sanitary condition of lands, workshops, dwellings, the number and size of rooms occupied by the poor, etc.; the cost of rent, fuel, food, clothing, and water in each locality of the State; also, the extent to which labor-saving processes are employed to the displacement of hand labor.
10. The number and condition of the Chinese in the State; their social and sanitary habits; number of married and of single; the number employed and the nature of their employment; the average wages per day at each employment, and the gross amount yearly; the amounts expended by them in rent, food, and clothing, and in what proportion such amounts are expended for foreign and home productions, respectively; to what extent their employment comes in competition with the white industrial classes of the State;
11. The number, condition, and nature of the employment of the inmates of the State prison, county jails, and reformatory institutions, and to what extent their employment comes in competition with the labor of mechanics, artisans, and laborers outside of these institutions;
12. All such other information in relation to labor as the Commissioner may deem essential to further the object sought to be obtained by this statute, together with such strictures on the condition of labor and the probable failure of the same, as he may deem good and salutary to insert in his biennial report.

SEC. 4. It shall be the duty of all officers of State departments, and the Assessors of the various counties of the State, to furnish, upon the written request of the Commissioner, all the information in their power necessary to assist in carrying out the objects of this Act; and all printing required by the Bureau in the discharge of its duty shall be performed by the State printing department, and at least three thousand copies of the printed report shall be furnished the Commissioner for free distribution to the public.

SEC. 5. Any person who willfully impedes or prevents the Commissioner, or his deputy, in the full and free performance of his or their duty, shall be guilty of a misdemeanor, and upon conviction of the same shall be fined not less than ten (10) nor more than fifty (50) [dollars], or imprisoned not less than seven (7) nor more than thirty (30) days in the county jail, or both.

SEC. 6. * * * The officers [of the Bureau] * * * shall give to all persons requesting it all needed information which they may possess.

SEC. 7 (as amended by Chapter X, Acts of 1889). The Commissioner shall have power to send for persons and papers whenever in his opinion it is necessary, and he may examine witnesses under oath, being hereby qualified to administer the same in the performance of his duty, and the testimony so taken must be filed and preserved in the office of said Commissioner; he shall have free access to all places and works of labor, and any principal, owner, operator, manager, or lessee of any mine, factory, workshop, warehouse, manufacturing or mercantile establishment, or any agent or employé of such principal, owner, operator, manager, or lessee, who shall refuse to said Commissioner, or his duly authorized representative, admission therein, or who shall, when requested by him, willfully neglect or refuse to furnish to him any statistics or information pertaining to his lawful duties which may be in the possession, or under the control of said principal, owner, operator, lessee, manager, or agent thereof, shall be punished by a fine of not less than fifty (50) nor more than two hundred (200) dollars.

SEC. 8 (added by Chapter X, Acts of 1889). No use shall be made in the reports of the Bureau of the names of individuals, firms, or corporations supplying the information called for by this Act, such information being deemed confidential, and not for the purpose of disclosing any person's affairs; and any agent or employé of said Bureau violating this provision shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine not to exceed five hundred dollars, or by imprisonment in the county jail not to exceed six (6) months.

SEC. 9 (as amended by Chapter X, Acts of 1889). The Commissioner shall appoint a deputy, who shall have the same powers as the said

Commissioner, and such agents and assistants, not exceeding three, as he may from time to time require. * * *

Chinese Labor—Employment of, etc.

Sections 2, 3, and 4 of Article XIX, Constitution of California, 1879; and Sections 178 and 179 of Penal Code of California, all relating to prohibition of the employment of Chinese on State, municipal, or other public works, or by corporations, held unconstitutional. (*In re Tiburcio Parrott*, 1 Federal Reporter, 481.)

Product of Chinese Labor Not to be Bought by State Officials.

(Political Code of California.)

SEC. 3235 (added by Chapter CLIII, Acts of 1887). No supplies of any kind or character, "for the benefit of the State, or to be paid for by any moneys appropriated or to be appropriated by the State," manufactured or grown in this State, which are in whole or in part the product of Mongolian labor, shall be purchased by the officials of the State having the control of any public institution under the control of the State, or of any county, city and county, city, or town thereof.

Exclusion of Chinese.

Act relating to exclusion of Chinese from the State of California, appearing in Stats. of Cal. 1891, p. 185, held unconstitutional by the Supreme Court of California in *ex parte Ah Cue*, 101 Cal. 197.

Convict Labor—Contract System Prohibited.

(Constitution of California, Article X.)

SEC. 6. After the first day of January, eighteen hundred and eighty-two, the labor of convicts shall not be let out by contract to any person, co-partnership, company, or corporation, and the Legislature shall, by law, provide for the working of convicts for the benefit of the State.

Convict Labor.

(Stats. of Cal. 1889, p. 404.)

SEC. 18. All convicts may be employed by authority of the Board of Directors, under charge of the Wardens, respectively, and such skilled

foremen as he may deem necessary, in the performance of the work for the State, or in the manufacture of any article or articles for the State, or the manufacture of which is sanctioned by law. At San Quentin, no articles shall be manufactured for sale except jute fabrics. At Folsom, after the completion of the dam and canal, the board may commence the erection of structures for jute-manufacturing purposes. The Board of Directors are hereby authorized to purchase, from time to time, such tools, machinery, and materials, and to direct the employment of such skilled foremen as may be necessary to carry out the provisions of this section, and to dispose of the articles manufactured, and not needed by the State, for cash, at private sale, in such manner as provided by law.

Sec. 20. The State Board of Prison Directors shall require of every able-bodied convict confined in a State prison as many hours of faithful labor in each and every day during his term of imprisonment as shall be prescribed by the rules and regulations of the prison. * * *

(Stats. of Cal. 1897, p. 457.)

Sec. 25. The Boards of Supervisors (county) in their respective counties, have jurisdiction and power, under such limitations and restrictions as are prescribed by law:

* * * * * * * *

29. To provide for the working of prisoners confined in the county jail, under judgment of conviction of misdemeanor, under the direction of some responsible person, to be appointed by the Sheriff, whose compensation shall not exceed one hundred dollars per month, upon the public grounds, roads, streets, alleys, highways, or public buildings, or in such other places as may be deemed advisable, for the benefit of the county.

Price and Conditions of Sale of Convict-Made Goods.

(Stats. of Cal. 1893, p. 54.)

Section 1. It shall be the duty of the State Board of Prison Directors from time to time, to fix the price, and to give public notice of the same, at which jute goods shall be sold by the State, but at no time shall the price fixed be more than one cent per bag in excess of the net cost of producing the same, exclusive of prison labor; and it is made the duty of the State prison authorities to confine the sale of jute goods to consumers direct, but no order shall be filled for any one individual or firm, during any one year, for more than five thousand grain bags, except on request of the Warden, and the unanimous approval of the State Board of Prison Directors.

Sec. 2. Demands for jute goods by consumers shall be promptly filled in the order in which they are made; but when the supply is

short, demands shall be registered at the prison in the order of their arrival, and filled from the output of the jute mill in the order of registration; *provided*, that on and after the fifteenth of June of each year, by and with the consent of the majority of the Board of Prison Directors, the Warden may fill orders for larger quantities to actual consumers, as they may, in their judgment, deem expedient; *provided*, that orders of farmers shall take precedence over all others; *provided further*, that ten per cent of the purchase price shall accompany each order, and the remaining portion must be paid upon the delivery of the goods.

Sec. 3. All orders for jute goods must be accompanied by an affidavit setting forth that the amount of goods contained in the order are for individual and personal use of the applicant, said affidavit to be subscribed and sworn to before some notary public or by a justice of the peace, residing in the township in which the applicant resides; *provided*, that any applicant, as heretofore provided for, who falsely or fraudulently procures jute goods under the provisions of this Act shall be guilty of a misdemeanor.

Convict Labor on Public Roads.

(Stats. of Cal. 1897, p. 6.)

Section 1. The State Prison Directors of the State of California are hereby authorized and directed, during the four years next succeeding the passage of this Act, to employ at least twenty prisoners daily, during fair weather, in the construction and repair of such public roads as have been, or shall hereafter be, laid out or opened by the Board of Supervisors of Marin County, and which extend from the San Quentin State Prison, or the grounds surrounding the same, to Point Tiburon and all railroad stations in Marin County which lie in the neighborhood of the said State prison.

Sec. 2. This Act shall take effect and be in force from and after its passage.

Convict Labor—Preparation of Road Metal.

(Stats. of Cal. 1895, p. 274.)

Section 1. The Governor of the State, the State Prison Directors, and the Bureau of Highways (or if the latter shall not be established, then and in that case the two first named) shall, when satisfied that fifty thousand cubic yards of prepared road or highway metal, as hereinafter described, will be taken for highway purposes, purchase, establish, and operate at one or both of the State prisons, a rock or stone crushing plant, to be operated by convict labor and by the application of power under control of the State Prison Directors, and with such free

labor as is necessary for superintendence and direction, to crush rock or stone into road metal for highway purposes, of different and necessary degrees of fineness; *provided*, that the authority and direction hereby and herein conferred and given, shall not be exercised or employed until the Governor and State Prison Directors are satisfied that transportation can be had for such highway metal for highway purposes at just and reasonable rates, and so as to justify the setting up and operation herein provided for of said plant.

Board of Prison Directors to Control Rock-Crushing Plant at Folsom.

(Stats. of Cal. 1897, p. 99.)

SECTION 1. The State Board of Prison Directors shall regulate, govern, and have full control of the rock or stone crushing plant established at the State Prison at Folsom, the product thereof, the revenues derived therefrom, and all appropriations of money therefor.

SEC. 2. The plant shall be operated by convict labor, and by the application of the mechanical and water power belonging to the State Prison at Folsom, together with such free labor as the State Board of Prison Directors may deem necessary for superintending, directing, and guarding the convicts employed thereon.

SEC. 3. The State Board of Prison Directors are hereby empowered and authorized to sell and to otherwise dispose of the crushed-rock product of the said plant; *provided*, that in all cases preference shall be given to orders received from the Bureau of Highways for crushed rock for road metal for highway purposes.

SEC. 4. The sale price of all crushed rock sold for road metal for highway purposes shall be the cost of production, with ten percentum added, delivered on board cars or other vehicles of transportation at the rock-crushing plant; *provided*, that no rock shall be sold for highway or other purposes for a less price than thirty cents per ton.

SEC. 5. The cost of production shall be ascertained by estimating the cost of explosives, oil, fuel, tools, repairs, free labor, supplementary machinery, the preparation and maintenance of beds, boxes, crates, or other unloading devices for carriage to and delivery from cars, of said crushed rock, the leasing of railroad cars, and the cost of such other materials, supplies, and expenses as may be required and used in producing each ton of crushed rock ready for sale delivery.

SEC. 6. The State Board of Prison Directors are hereby authorized to lease railroad cars, with equipments suitable for the rapid and economical handling and delivery of crushed rock, prepared as aforesaid, whenever in their judgment the interest of the people of the State will be conserved thereby, in the matter of highway construction by the use of said

crushed rock. The cost of said leasing shall be carried into the cost of production described in section five.

SEC. 7. The amount of five thousand dollars heretofore appropriated is hereby set apart to and for the usage of the State Board of Prison Directors, to provide and maintain a permanent revolving fund for the purpose of operating and maintaining the rock-crushing plant at Folsom Prison. The money taken from said revolving fund shall be used exclusively for operating and maintaining the said rock-crushing plant. So much of the money received from the sale of crushed rock as shall be necessary to that end, shall be returned to said revolving fund, as it is needed, to keep the same constantly at the said figure of five thousand dollars.

SEC. 8. Whenever the revolving fund shall be replenished, and there shall be a surplus, or balance, over the amount appropriated, this surplus, or balance, shall be paid, not less frequently than semi-annually, into the State treasury, to the credit of the fund known as "The State Prison Fund of Folsom Prison," for the use and support of Folsom Prison.

SEC. 9. The clerk of the State Prison at Folsom shall keep such records, books, and accounts as may be necessary to at all times clearly exhibit the financial business and other transactions of the said rock-crushing plant. All such records, books, and accounts shall be kept separate and distinct from those relating to other prison affairs.

SEC. 10. For all sums of money herein required to be paid, drafts shall be drawn on the Controller of the State, signed by at least three members of the State Board of Prison Directors. Said drafts shall be sent to the State Board of Examiners, to be by them approved, and after approval by said State Board of Examiners, the Controller of State shall draw his warrant in behalf of said State Board of Prison Directors on the State Treasurer, who shall pay the same, on presentation of such warrant; *provided*, that the State Board of Examiners is hereby expressly prohibited from approving of any of said drafts until the same are presented with itemized statements, showing specifically the services rendered, by whom performed, time employed, distance traveled, and necessary expenses thereof; if for articles purchased, the said statement shall give the name of each article, together with the price paid for each, and of whom purchased, together with the date purchased.

SEC. 11. If any of the buildings, machinery, or structures appertaining to or comprising the said rock-crushing plant are destroyed in any way, or injured by fire or otherwise, they may be rebuilt or repaired immediately, under the direction of the State Board of Prison Directors, by and with the consent solely of the Governor, the Attorney-General, and the Secretary of State, and the expenses thereof, not to exceed in amount the sum of ten thousand dollars, shall be paid out of any funds in the State treasury not otherwise appropriated by law, and the provisions of

no other Act shall apply to or govern or limit this section, or any of the powers or duties herein conferred.

SEC. 12. The State Board of Prison Directors are hereby authorized and empowered to perform such other acts and duties as may be necessary to carry out the full intent and meaning of this Act.

SEC. 13. All Acts and parts of Acts inconsistent with the provisions of this Act are hereby repealed.

SEC. 14. This Act shall take effect immediately.

Co-operative Associations.

(Stats. of Cal. 1895, p. 221.)

SECTION 1. It shall be lawful for five or more persons to form a coöperative association for the purpose of transacting any lawful business. Such associations shall not have or issue any capital stock, but shall issue membership certificates to each member thereof, and such membership certificate cannot be assigned so that the transferee thereof can by such transfer become a member of the association except by the resolution of the board of directors of the association. But by the resolution of consent of the board of directors, such certificate may be transferred, so that the transferee may become a member in lieu of the last former holder thereof.

SEC. 2. In such association the rights and interest of all members shall be equal, and no member can have or acquire a greater interest therein than any other member has. At every election held pursuant to the by-laws each member shall be entitled to cast one vote and no more. All persons above the age of eighteen years, regardless of sex, shall be eligible to membership, if otherwise qualified and elected as the by-laws may provide. The by-laws shall provide for the amount of the indebtedness which such association may incur. And no member shall be responsible individually, or personally liable, for any of the debts or liabilities of the association in excess of his proportion of such indebtedness; but in case of the failure and insolvency of such association, may be required to pay any unpaid dues or installments which have, before such insolvency, become due from such member to the association, pursuant to its by-laws.

SEC. 3. Every association formed under this Act shall prepare articles of association, in writing, which shall set forth: The name of the association, the purpose for which it is formed, the place where its principal business is to be transacted, the term for which it is to exist (not to exceed fifty years), the number of the directors thereof, and the name and residence of those selected for the first year, the amount which each member is to pay upon admission as membership fee, and that each

member signing the articles has actually paid in such sum, and that the interest and right of each member therein is to be equal. Such articles of association must be subscribed by the original associates or members, and acknowledged by each before some person competent to take an acknowledgment of a deed in this State. Such articles so subscribed and acknowledged shall be filed in the office of the Secretary of State, who shall furnish a certified copy thereof, which shall be filed in the office of the County Clerk of the county where the principal business of such association is to be transacted; and from the time of such filing in the office of the said County Clerk the association shall be complete, and shall have and exercise all the powers for which it was formed.

SEC. 4. Every association formed under this Act must within forty days after it shall so become an association, adopt a code of by-laws for the government and management of the association, not inconsistent with this Act. A majority of all the associates shall be necessary to the adoption of such by-laws, and the same must be written in a book and subscribed by the members adopting the same; and the same cannot be amended or modified except by the vote of a majority of all the members, after notice of the proposed amendment shall be given, as the by-laws may provide. Such association may, by its code of by-laws, provide for the time, place, and manner of calling and conducting its meetings; the number of directors, the time of their election, their term of office, the mode and manner of their removal, the mode and manner of filling vacancies in the board caused by death, resignation, removal, or otherwise, and the power and authority of such directors, and how many thereof shall be necessary to the exercise of the powers of such directors, which must be at least a majority; the compensation of any of the directors, or of any officers; the number of the officers, if any, other than the directors, and their term of office; the mode of removal, and the method of filling a vacancy; the mode and manner of conducting business; the mode and manner of conducting elections, and may provide for voting by ballots forwarded by mail or otherwise; *provided*, the method shall secure the secrecy of the ballot; the mode and manner of succession of membership, and the qualifications for membership, and on what conditions, and when membership shall cease, and the mode and manner of expulsion of a member, subject to the right that an expelled member shall have a right to have the board of directors appraise his interest in the association in either money, property, or labor, as the directors shall deem best, and to have the money, property, or labor so awarded him paid, or delivered, or performed within forty days after expulsion; the amount of membership fee, and the dues, installments, or labor which each member shall be required to pay or perform, if any, and the manner of collection or enforcement, and for forfeiting or selling of membership interest for non-payment or non-

performance; the method, time, and manner of permitting the withdrawal of a member, if at all, and how his interest shall be ascertained, either in money or property, and within what time the same shall be paid or delivered to such member; the mode and manner of ascertaining the interest of a member at his death, if his legal representatives or none of them desire to succeed to the membership, and whether the same shall be paid to his legal representatives in money, or property, or labor, and within what time the same shall be paid, or delivered, or performed; such other things as may be proper to carry out the purpose for which the association was formed.

Sec. 5. The by-laws and all amendments must be recorded in a book and kept in the office of the association, and a copy, certified by the directors, must be filed in the office of the County Clerk where the principal business is transacted.

Sec. 6. The property of such association shall be subject to judgment and execution for the lawful debts of the association. The interest of a member in such association, if sold upon execution, or any judicial or governmental order whatever, cannot authorize the purchaser to have any right, except to succeed, as a member in the association, with the consent of the directors, to the rights of the member whose interest is thus sold. If the directors shall choose to pay or settle the matter after such sale, they may either cancel the membership, and add the interest thus sold to the assets or common property of the association, or reissue the share or right to a new member upon proper payment therefor, as the directors may determine.

Sec. 7. The purpose of the business may be altered, changed, modified, enlarged, or diminished by a vote of two thirds of all the members, at a special election to be called for such purpose, of which notice must be given the same as the by-laws shall provide for the election of directors.

Sec. 8. The by-laws shall provide for the time and manner in which profits shall be divided between the members, and what proportion of the profits, if any, shall be added to the common property or funds of the association. But the by-laws may provide that the directors may suspend or pass the payment of any such profit, or installment of earnings, at their discretion.

Sec. 9. Every association formed under this Act shall have power of succession by its associate name for fifty years; to, in such name, sue and be sued in any court; to make and use a common seal, and alter the same at pleasure; to receive by gift, devise, or purchase, hold, and convey real and personal property, as the purposes of the association may require; to appoint such subordinate agents or officers as the business may require; to admit associates or members, and to sell or forfeit their interest in the association for default of installments, or dues, or

work, or labor required, as provided by the by-laws; to enter into any and all lawful contracts or obligations essential to the transaction of its affairs, for the purpose for which it was formed, and to borrow money, and issue all such notes, bills, or evidences of indebtedness or mortgage as its by-laws may provide for; to trade, barter, buy, sell, exchange, and to do all other things proper to be done for the purpose of carrying into effect the objects for which the association is formed.

Sec. 10. Two or more associations formed and existing under this Act may be consolidated together, upon such terms, and for such purposes, and by such name, as may be agreed upon, in writing, signed by two thirds of the members of each such association. Such agreement must also state all the matters necessary to articles of association, and must be acknowledged by the signers before an officer competent to take an acknowledgment of deeds in this State, and be filed in the office of the Secretary of State, and a certified copy thereof be filed in the office of the County Clerk of the county where its principal business is to be transacted; and from and after the filing of such certified copy, the former associations comprising component parts shall cease to exist, and the consolidated association shall succeed to all the rights, duties, and powers of the component associations, and be possessed of all the rights, duties, and powers prescribed in the agreement of the consolidated association not inconsistent with this Act, and shall be subject to all the liabilities and obligations of the former component associations, and succeed to all the property and interests thereof, and may make by-laws and do all things permitted by this Act.

Sec. 11. Any association formed or consolidated under this Act may be dissolved and its affairs wound up voluntarily by the written request of two thirds of the members. Such requests shall be addressed to the directors, and shall specify reasons why the winding-up of the affairs of the association is deemed advisable, and shall name three persons who are members to act in liquidation and in winding-up the affairs of the association, a majority of whom shall thereupon have full power to do all things necessary to liquidation; and upon the filing of such request with the directors, and a copy thereof in the office of the County Clerk of the county where the principal business is transacted, all power of the directors shall cease and the persons appointed shall proceed to wind-up the association, and realize upon its assets, and pay its debts, and divide the residue of its money among the members, share and share alike, within a time to be named in said written request, or such further time as may be granted them by two thirds of the members, in writing, filed in the office of said County Clerk; and upon the completion of such liquidation the said association shall be deemed dissolved. No receiver of any such association, or of any property thereof, or of any right therein, can be appointed by any court, upon

the application of any member, save after judgment of dissolution for usurping franchises at the suit of the State of California by its Attorney-General.

Sec. 12. The right of any association claiming to be organized under this Act to do business may be inquired into by quo warranto, at the suit of the Attorney-General of this State, but not otherwise.

Sec. 13. This Act being passed to promote association for mutual welfare, the words "lawful business" shall extend to every kind of lawful effort for business, educational, industrial, benevolent, social, or political purposes, whether conducted for profit or not, and this Act shall not be strictly construed, but its provisions must at all times be liberally construed, with a view to effect its object and to promote its purposes.

Definition of Employment.

(Civil Code of California.)

Sec. 1965. The contract of employment is a contract by which one, who is called the employer, engages another, who is called the employé, to do something for the benefit of the employer or of a third person.

Hours of Labor.

(Political Code of California.)

Sec. 3244 (as amended by Chapter LXXXV, Acts of 1887). Eight hours of labor constitute a day's work, unless it is otherwise expressly stipulated by the parties to a contract, except those contracts within the provisions of sections three thousand two hundred and forty-six, three thousand two hundred and forty-seven, and three thousand two hundred and forty-eight of this Code.

Sec. 3245. See "Public Work."

Sec. 3246 (added by Chapter LXXXV, Acts of 1887). Twelve hours' labor constitutes a day's work on the part of drivers, and conductors, and gripmen of street-cars for the carriage of passengers. Any contract for a greater number of hours' labor in one day shall be and is void, at the option of the employé, without regard to the terms of employment, whether the same be by the hour, day, week, month, or any other period of time, or by or according to the trip or trips that the car may, might, or can make between the termini of the route, or any less distance thereof. Any and every person laboring over twelve hours in one day as driver, or conductor, or gripman on any street railroad, shall receive from his employer thirty cents for each hour's labor over twelve hours in each day.

SEC. 3247 (added by Chapter XLIX, Acts of 1897). Any person, committee, board, officer, or any other person charged with the purchase, or permitted or authorized to purchase supplies, goods, wares, merchandise, manufactures, or produce, for the use of the State, or of any of its institutions or officers, or for the use of any county, or consolidated city and county, or city, or town, shall always, price, fitness, and quality being equal, prefer such supplies, goods, wares, merchandise, manufactures, or produce as has been grown, manufactured, or produced in this State, and shall next prefer such as has been partially so manufactured, grown, or produced in this State. All State, county, city and county, city, or town officers, all boards, commissions, or other persons charged with advertising for any such supplies, shall state in their advertisement that such preferences will be made. In any such advertisement no bids shall be asked for any article of a specified brand or mark, nor any patent apparatus or appliance, when such requirement would prevent proper competition on the part of dealers in other articles of equal value, utility, or merit.

SEC. 3248 (in effect March 11, 1887). In actions under section three thousand two hundred and forty-six of this Code the complaint may be in the following form: Title of cases and venue. Plaintiff complains of defendant, and for cause of action states: That between (stating first and last dates), he worked for defendant as conductor, driver, or gripman, on defendant's street railroad in (stating place), for (stating number of days), at the agreed rate of (stating price) per day, week, or month, and for such labor defendant has paid plaintiff the sum of (stating sum due) due plaintiff from defendant for said labor. The plaintiff further states that during the said period of time he worked for defendant as such (conductor, driver, or gripman), on sundry days and performed (stating number of hours) hours' work in excess of twelve hours in one day, for which there is due plaintiff from defendant the sum of (stating the sum due), and costs.

SEC. 3249 (added by Chapter LXXXV, Acts of 1887). The provisions of sections three thousand two hundred and forty-seven * * * of this Code are applicable to every contract to labor made by the persons named in section three thousand two hundred and forty-six.

SEC. 3250 (added by Chapter LXXXV, Acts of 1887). No person shall be employed as conductor, or driver, or gripman, on any street railroad, for more than twelve hours in one day, except as in this Act provided; and any corporation, or company, or owner, or agent, or superintendent, who knowingly employs any person in such capacity for more than twelve hours in one day, in violation of the terms of this Act, shall forfeit the sum of fifty dollars as a penalty for such offense, to the use of the person prosecuting any action therefor, and any number of forfeits may be prosecuted in one action.

Time to Vote to be Allowed Employes.

(Political Code of California.)

Sec. 1212 (as amended by Chapter CXXX, Acts of 1891). Any person entitled to vote at a general election held within this State shall, on the day of such election, be entitled to absent himself from any service or employment in which he is then engaged, or employed, for the period of two consecutive hours, between the time of opening and the time of closing the polls; and such voter shall not, because of so absenting himself, be liable to any penalty, nor shall any deduction be made, on account of such absence, from his usual salary or wages.

Obligations of Employer.

(Civil Code of California.)

Sec. 1969. An employer must indemnify his employé, except as prescribed in the next section, for all that he necessarily expends or loses in direct consequence of the discharge of his duties as such, or of his obedience to the directions of the employer, even though unlawful, unless the employé, at the time of obeying such directions, believed them to be unlawful.

Sec. 1970. An employer is not bound to indemnify his employé for losses suffered by the latter in consequence of the ordinary risks of the business in which he is employed, nor in consequence of the negligence of another person employed by the same employer in the same general business, unless he has neglected to use ordinary care in the selection of the culpable employé.

Sec. 1971. An employer must in all cases indemnify his employés for losses caused by the former's want of ordinary care.

Obligations of Employe.

(Civil Code of California.)

Sec. 1975. One who, without consideration, undertakes to do a service for another, is not bound to perform the same, but if he actually enters upon its performance, he must use at least slight care and diligence therein.

Sec. 1976. One who, by his own special request, induces another to intrust him with the performance of a service, must perform the same fully. In other cases, one who undertakes a gratuitous service may relinquish it at any time.

Sec. 1977. A gratuitous employé who accepts a written power of

attorney must act under it so long as it remains in force, or until he gives notice to his employer that he will not do so.

SEC. 1978. One who, for a good consideration, agrees to serve another must perform the service, and must use ordinary care and diligence therein, so long as he is thus employed.

SEC. 1979. One who is employed at his own request to do that which is more for his own advantage than for that of his employer must use great care and diligence therein to protect the interest of the latter.

SEC. 1980. A contract to render personal service, other than a contract of apprenticeship, * * * can not be enforced against the employé beyond the term of two years from the commencement of service under it; but if the employé voluntarily continues his service under it beyond that time, the contract may be referred to as affording a presumptive measure of the compensation.

SEC. 1981. An employé must substantially comply with all the directions of his employer concerning the service on which he is engaged, except where such obedience is impossible or unlawful, or would impose new and unreasonable burdens upon the employé.

SEC. 1982. An employé must perform his service in conformity to the usage of the place of performance, unless otherwise directed by his employer, or unless it is impracticable, or manifestly injurious to his employer to do so.

SEC. 1983. An employé is bound to exercise a reasonable degree of skill, unless his employer has notice, before employing him, of his want of skill.

SEC. 1984. An employé is always bound to use such skill as he possesses, so far as the same is required, for the service specified.

SEC. 1985. Everything which an employé acquires by virtue of his employment, except the compensation, if any, which is due to him from his employer, belongs to the latter, whether acquired lawfully or unlawfully, or during or after the expiration of the term of his employment.

SEC. 1986. An employé must, on demand, render to his employer just accounts of all his transactions in the course of his service, as often as may be reasonable, and must, without demand, give prompt notice to his employer of everything which he receives for his account.

SEC. 1987. An employé who receives anything on account of his employer, in any capacity other than that of a mere servant, is not bound to deliver to him until demanded, and is not at liberty to send it to him from any distance, without demand, in any mode involving greater risk than its retention by the employé himself.

SEC. 1988. An employé who has any business to transact on his own account, similar to that entrusted to him by his employer, must always give the latter the preference.

SEC. 1989. An employé who is expressly authorized to employ a

substitute is liable to his principal only for want of ordinary care in his selection. The substitute is directly responsible to the principal.

SEC. 1990. An employé who is guilty of a culpable degree of negligence is liable to his employer for the damage thereby caused to the latter; and the employer is liable to him, if the service is not gratuitous, for the value of such services only as are properly rendered.

SEC. 1991. Where service is to be rendered by two or more persons jointly, and one of them dies, the survivor must act alone, if the service to be rendered is such as he can rightly perform without the aid of the deceased person, but not otherwise.

Termination of Employment.

(Civil Code of California.)

SEC. 1996. Every employment in which the power of the employé is not coupled with an interest in its subject is terminated by notice to him of: (1) The death of the employer; or, (2) His legal incapacity to contract.

SEC. 1997. Every employment is terminated: (1) By the expiration of its appointed term; (2) By the extinction of its subject; (3) By the death of the employé; or, (4) By his legal incapacity to act as such.

SEC. 1998. An employé, unless the term of his service has expired, or unless he has a right to discontinue it at any time without notice, must continue his service after notice of the death or incapacity of his employer, so far as is necessary to protect from serious injury the interests of the employer's successor in interest until a reasonable time after notice of the facts have been communicated to such successor. The successor must compensate the employé for such service according to the terms of the contract of employment.

SEC. 1999. An employment having no specified term may be terminated at the will of either party, on notice to the other, except where otherwise provided by this title.

SEC. 2000. An employment, even for a specified term, may be terminated at any time by the employer, in case of any willful breach of duty by the employé in the course of his employment, or in case of his habitual neglect of his duty or continued incapacity to perform it.

SEC. 2001. An employment, even for a specified term, may be terminated by the employé at any time, in case of any willful or permanent breach of the obligations of his employer to him as an employé.

SEC. 2002. An employé, dismissed by his employer for good cause, is not entitled to any compensation for services rendered since the last day upon which a payment became due to him under the contract.

SEC. 2003. An employé who quits the service of his employer for good cause is entitled to such proportion of the compensation which would become due in case of full performance as the services which he has already rendered bear to the services which he was to render as full performance.

Master and Servant.

(Civil Code of California.)

SEC. 2009. A servant is one who is employed to render personal service to his employer, otherwise than in the pursuit of an independent calling, and who in such service remains entirely under the control and direction of the latter, who is called his master.

SEC. 2010. A servant is presumed to have been hired for such length of time as the parties adopt for the estimation of wages. A hiring at a yearly rate is presumed to be for one year; a hiring at a daily rate for one day; a hiring by piece work, for no specified term.

SEC. 2011. In the absence of any agreement or custom as to the term of service, the time of payment, or rate or value of wages, a servant is presumed to be hired by the month, at a monthly rate of reasonable wages, to be paid when the service is performed.

SEC. 2012. Where after the expiration of an agreement respecting the wages and the term of service, the parties continue the relation of master and servant, they are presumed to have renewed the agreement for the same wages and term of service.

SEC. 2013. The entire time of a domestic servant belongs to the master; and the time of other servants to such an extent as is usual in the business in which they serve, not exceeding in any case ten hours in the day.

SEC. 2014. A servant must deliver to his master, as soon as with reasonable diligence he can find him, everything that he receives for his account, without demand; but he is not bound, without orders from his master, to send anything to him through another person.

SEC. 2015. A master may discharge any servant, other than an apprentice, whether engaged for a fixed term or not:

1. If he is guilty of misconduct in the course of his service, or of gross immorality, though unconnected with the same; or

2. If, being employed about the person of the master, or in a confidential position, the master discovers that he has been guilty of misconduct, before or after the commencement of his service, of such nature that, if the master had known or contemplated it, he would not have so employed him.

Mates and Seamen.

(Civil Code of California.)

Sec. 2049. All persons employed in the navigation of a ship, or upon a voyage, other than the master and mate, are to be deemed seamen within the provisions of this Code.

Sec. 2050. The mate and seaman of a ship are engaged by the master, and may be discharged by him at any period of the voyage, for willful and persistent disobedience or gross disqualification, but cannot otherwise be discharged before the termination of the voyage.

Sec. 2051. A mate or seaman is not bound to go to sea in a ship that is not seaworthy; and if there is reasonable doubt of its seaworthiness, he may refuse to proceed until a proper survey has been had.

Sec. 2052. A seaman cannot, by reason of any agreement, be deprived of his lien upon the ship, or of any remedy for the recovery of his wages to which he would otherwise have been entitled. Any stipulation by which he consents to abandon his right to wages in case of the loss of the ship, or to abandon any right he may have or obtain in the nature of salvage, is void.

Sec. 2054. Except as hereinafter provided, the wages of seamen are due when and so far only as freightage is earned, unless the loss of freightage is owing to the fault of the owner or master.

Sec. 2055. The right of a mate or seaman to wages and provisions begins either from the time he begins work, or from the time specified in the agreement for his beginning work, or from his presence on board, whichever first happens.

Sec. 2056. Where a voyage is broken up before the departure of the ship, the seamen must be paid for the time they have served, and may retain for their indemnity such advances as they have received.

Sec. 2057. When a mate or seaman is wrongfully discharged, or is driven to leave the ship by the cruelty of the master on the voyage, it is then ended with respect to him, and he may thereupon recover his full wages.

Sec. 2058. In case of loss or wreck of the ship, a seaman is entitled to his wages up to the time of the loss or wreck, whether freightage has been earned or not, if he exerts himself to the utmost to save the ship, cargo, and stores.

Sec. 2063. Desertion of the ship without cause, or justifiable discharge by the master during the voyage for misconduct, or a theft of any part of the cargo or appurtenances of the ship, or a willful injury thereto or to the ship, forfeits all wages due for the voyage to a mate or seaman thus in fault.

Sec. 2064. A mate or seaman may not, under any pretext, ship goods on his own account without permission from the master.

Service Without Employment.

(Civil Code of California.)

SEC. 2078. One who officiously, and without the consent of the real or apparent owner of a thing, takes it into his possession for the purpose of rendering a service about it, must complete such service, and use ordinary care, diligence, and reasonable skill about the same. He is not entitled to any compensation for his service or expenses, except that he may deduct actual and necessary expenses incurred by him about such service from any profits which his service has caused the thing to acquire for its owner, and must account to the owner for the residue.

Negligence of Engineers of Steam Boilers, Etc.

(Penal Code of California.)

SEC. 349. Every engineer or other person having charge of any steam boiler, steam engine, or other apparatus for generating or employing steam, used in any manufactory, railroad, or other mechanical works, who willfully or from ignorance, or gross neglect, creates, or allows to be created, such an undue quantity of steam as to burst or break the boiler or engine, or apparatus, or cause any other accident whereby human life is endangered, is guilty of a felony.

Factories, Workshops, Etc.—Health of Employes.

(Stats. of Cal. 1889, p. 3.)

SECTION 1. Every factory, workshop, mercantile or other establishment, in which five or more persons are employed, shall be kept in a cleanly state, free from the effluvia arising from any drain, privy, or other nuisance, and shall be provided, within reasonable access, with a sufficient number of water-closets or privies for the use of persons employed therein. Whenever the persons employed as aforesaid are of different sexes, a sufficient number of separate and distinct water-closets or privies shall be provided for the use of each sex, which shall be plainly so designated, and no person shall be allowed to use any water-closet or privy assigned to persons of the other sex.

SEC. 2. Every factory or workshop in which five or more persons are employed shall be so ventilated while work is carried on therein that the air shall not become so exhausted as to be injurious to the health of the persons employed therein, and shall also be so ventilated as to render harmless, as far as practicable, all the gases, vapors, dust, or other impurities generated in the course of the manufacturing process or handicraft carried on therein that may be injurious to health.

SEC. 3. No basement, cellars, underground apartments, or other place which the Commissioner of the Bureau of Labor Statistics shall condemn as unhealthy and unsuitable shall be used as a workshop, factory, or place of business in which any person or persons shall be employed.

SEC. 4. If in any factory or workshop any process of work is carried on by which dust, filaments, or injurious gases are generated or produced that are liable to be inhaled by the persons employed therein, and it appears to the Commissioner of the Bureau of Labor Statistics that such inhalation could, to a great extent, be prevented by the use of some mechanical contrivance, he shall direct that such contrivance shall be provided, and within a reasonable time it shall be so provided and used.

SEC. 5. Every person, firm, or corporation employing females in any manufacturing, mechanical, or mercantile establishment shall provide suitable seats for the use of the females so employed, and shall permit the use of such seats by them when they are not necessarily engaged in the active duties for which they are employed.

SEC. 6. Any person or corporation violating any of the provisions of this Act shall be punished by a fine of not less than fifty (50) nor more than one hundred (100) dollars for each offense.

SEC. 7. It shall be the duty of the Commissioner of the Bureau of Labor Statistics to enforce the provisions of this Act.

Protection of Employes as Members of Labor Unions.

(Penal Code of California.)

SEC. 679 (added by Chapter CXLIX, Acts of 1893). Any person or corporation within this State, or agent or officer on behalf of such person or corporation, who shall hereafter coerce or compel any person or persons to enter into an agreement, either written or verbal, not to join or become a member of any labor organization, as a condition of such person or persons securing employment or continuing in the employment of any such person or corporation, shall be guilty of a misdemeanor.

Purity of Elections and Protection of Free Suffrage.

(Stats. of Cal. 1893, p. 12.)

SEC. 19. It shall be unlawful for any person, directly or indirectly, by himself or through any other person—

* * * * * * * *

2. To give, offer, or promise any office, place, or employment, or to

promise to procure, or endeavor to procure, any office, place, or employment, to or for any voter, or to or for any other person, in order to induce such voter to vote or refrain from voting at any election or to induce any voter to vote or refrain from voting at such election for any particular person or persons.

*   *   *   *   *   *   *   *

Every person who commits any of the offenses mentioned in this section is punishable, upon conviction thereof, by imprisonment in the State prison for not less than one year nor more than seven years.

Sec. 20. It shall be unlawful for any person, directly or indirectly, by himself or through any other person—

1. To receive, agree, or contract for, before or during an election, any money, gift, loan, or other valuable consideration, office, place, or employment, for himself or any other person, for voting or agreeing to vote, or for coming or agreeing to come to the polls, or for refraining or agreeing to refrain from voting, or for voting or agreeing to vote, or refraining or agreeing to refrain from voting, for any particular person or persons at any election.

*   *   *   *   *   *   *   *

Every person who commits any of the offenses mentioned in this section is punishable, upon conviction, by imprisonment in the State prison for not less than one nor more than seven years.

Sec. 41. It shall be unlawful for any person, directly or indirectly, by himself or any other person in his behalf, to make use of, or threaten to make use of, any force, violence, or restraint, or to inflict or threaten the infliction, by himself or through any other person, of any injury, damage, harm, or loss, or in any manner to practice intimidation upon or against any person, in order to induce or compel such person to vote or refrain from voting at any election, or to vote or to refrain from voting for any particular person or persons at any election, or on account of such person or persons at any election, or on account of such person having voted or refrained from voting at any election. And it shall be unlawful for any person, by abduction, duress, or any forcible or fraudulent device, or contrivance whatever, to impede, prevent, or otherwise interfere with the free exercise of the elective franchise by any voters; or to compel, induce, or prevail upon any voter either to give or refrain from giving his vote at any election, or to give or refrain from giving his vote for any particular person or persons at any election. It shall not be lawful for any employer, in paying his employés the salary or wages due them, to enclose their pay in "pay envelopes" upon which there is written or printed the name of any candidate or any political mottoes, devices, or arguments containing threats, express or implied, intended or calculated to influence the political opinions or actions of such employés. Nor shall it be lawful for any employer,

within ninety days of an election, to put up or otherwise exhibit in his factory, workshop, or other establishment, or place where his workmen or employés may be working, any handbill or placard containing any threat, notice, or information, that in case any particular ticket of a political party, or organization, or candidate, shall be elected, work in his place or establishment will cease, in whole or in part, or his place or establishment will be closed up, or the salaries or wages of his workmen or his employés be reduced, or other threats, expressed or implied, intended or calculated to influence the political opinions or actions of his workmen or employés. This section shall apply to corporations as well as individuals, and any person or corporation violating the provisions of this section is guilty of a misdemeanor, and any corporation violating this section shall forfeit its charter.

Exemption from Execution, Etc.

(Constitution of California, Article XVII.)

Section 1. The Legislature shall protect, by law, from forced sale a certain portion of the homestead and other property of all heads of families.

Exemption from Execution, Etc.—Homesteads.

(Civil Code of California.)

Sec. 1240. The homestead is exempt from execution or forced sale, except as in this title provided.

Sec. 1241 (as amended by Chapter LXXI, Acts of 1887). The homestead is subject to execution or forced sale in satisfaction of judgments obtained:

1. Before the declaration of homestead was filed for record, and which constitute liens upon the premises.

2. On debts secured by mechanics', contractors', subcontractors', artisans', architects', builders', laborers' of every class, material-men's, or vendors' liens upon the premises.

3. On debts secured by mortgages on the premises, executed and acknowledged by husband and wife, or by an unmarried claimant.

4. On debts secured by mortgages on the premises, executed and recorded before the declaration of homestead was filed for record.

Exemption from Execution—Personal Property.

(Code of Civil Procedure of California.)

Sec. 690 (as amended by Chapter XIX, Acts of 1899, p. 19). The following property is exempt from execution, except as herein otherwise specially provided:

1. Chairs, tables, desks, and books, to the value of two hundred dollars, belonging to the judgment debtor;

2. Necessary household, table, and kitchen furniture belonging to the judgment debtor, including one sewing-machine, stove, stovepipes, and furniture, wearing apparel, beds, bedding and bedsteads, hanging pictures, oil paintings and drawings drawn or painted by any member of the family, and family portraits and their necessary frames, provisions actually provided for individual or family use sufficient for three months, and three cows and their sucking calves, four hogs with their sucking pigs, and food for such cows and hogs for one month; also, one piano, one shotgun, and one rifle;

3. The farming utensils or implements of husbandry of the judgment debtor, not exceeding in value the sum of one thousand dollars; also, two oxen or two horses, or two mules, and their harness, one cart or wagon, and food for such oxen, horses, or mules, for one month; also, all seed, grain, or vegetables actually provided, reserved, or on hand for the purpose of planting or sowing at any time within the ensuing six months, not exceeding in value the sum of two hundred dollars; and seventy-five beehives, and one horse and vehicle belonging to any person who is maimed or crippled, and the same is necessary in his business;

4. The tools or implements of a mechanic or artisan necessary to carry on his trade; the notarial seal, records, and office furniture of a notary public; the instruments and chest of a surgeon, physician, surveyor, or dentist, necessary to the exercise of their profession, with their professional libraries and necessary office furniture; the professional libraries of attorneys, judges, ministers of the gospel, editors, school teachers, and music teachers, and their necessary office furniture; also, the musical instruments of music teachers actually used by them in giving instructions, and all the indexes, abstracts, books, papers, maps, and office furniture of a searcher of records, necessary to be used in his profession; also, typewriters, or other mechanical contrivances employed for writing in type, actually used by the owner thereof for making his living; also, one bicycle, when the same is used by its owner for the purpose of carrying on his regular business, or when the same is used for the purpose of transporting the owner to and from his place of business;

5. The cabin or dwelling of a miner, not exceeding in value the sum of five hundred dollars; also, his sluices, pipes, hose, windlass, derrick, cars, pumps, tools, implements, and appliances necessary for carrying

on any mining operations, not exceeding in value the aggregate sum of five hundred dollars; and two horses, mules, or oxen, with their harness, and food for such horses, mules, or oxen for one month, when necessary to be used in any whim, windlass, derrick, car, pump, or hoisting gear; and also his mining claim, actually worked by him, not exceeding in value the sum of one thousand dollars;

6. Two horses, two oxen, or two mules, and their harness, and one cart or wagon, one dray or truck, one coupé, one hack or carriage, for one or two horses, by the use of which a cartman, drayman, truckman, huckster, peddler, hackman, teamster, or other laborer habitually earns his living, and one horse, with vehicle and harness or other equipments, used by physician, surgeon, constable, or minister of the gospel, in the legitimate practice of his profession or business, with food for such oxen, horses, or mules, for one month;

7. One fishing boat and net, not exceeding the total value of five hundred dollars, the property of any fisherman, by the lawful use of which he earns a livelihood;

8. Poultry not exceeding in value twenty-five dollars;

9. Seamen's and sea-going fishermen's wages and earnings, not exceeding one hundred dollars;

10. The earnings of the judgment debtor for his personal services rendered at any time within thirty days next preceding the levy of execution or attachment, when it appears, by the debtor's affidavit or otherwise, that such earnings are necessary for the use of his family, residing in this State, supported in whole or in part by his labor; but where debts are incurred by any such person, or his wife or family, for the common necessaries of life, or have been incurred at a time when the debtor had no family, residing in this State, supported in whole or in part by his labor, the one half of such earnings above mentioned are nevertheless subject to execution, garnishment, or attachment to satisfy debts so incurred;

11. The shares held by a member of a homestead association duly incorporated, not exceeding in value one thousand dollars, if the person holding the shares is not the owner of a homestead under the laws of this State.

All the nautical instruments and wearing apparel of any master, officer, or seaman of any steamer or other vessel;

12. All moneys, benefits, privileges, or immunities accruing or in any manner growing out of any life insurance on the life of the debtor, if the annual premiums paid do not exceed five hundred dollars;

* * * * * * * *

14. All arms, uniforms, and accouterments required by law to be kept by any person, and also one gun to be selected by the debtor;

* * * * * * * *

No article, however, or species of property mentioned in this section,

is exempt from execution issued upon a judgment recovered for its price, or upon a judgment of foreclosure of a mortgage thereon.

License Tax on Business.

(County Government Act, Chapter CCLXXVII, Section 25, Stats. of Cal. 1897, p. 452.)

SUBDIVISION 25. To license, for purposes of regulation and revenue, all and every kind of business not prohibited by law, and transacted and carried on in such county, and all shows, exhibitions, and lawful games carried on therein; to fix the rates of license tax upon the same, and to provide for the collection of the same, by suit or otherwise; *provided*, that every honorably discharged soldier, sailor, or marine of the United States, who is unable to obtain a livelihood by manual labor, shall have the right to hawk, peddle, and vend any goods, wares, or merchandise, except spirituous, malt, vinous, or other intoxicating liquor, without payment of any license, tax, or fee whatsoever, whether municipal, county, or State; and the Board of Supervisors shall issue to such soldier, sailor, or marine, without cost, a license therefor. The board may provide that any such license shall cease upon the non-payment of such tax, and any person, firm, or corporation transacting or carrying on such business, without such license whenever prescribed, is guilty of a misdemeanor.

License Tax—Intelligence Office.

(Order 1589 of the Board of Supervisors of the City and County of San Francisco.)

SECTION 44. Each keeper of an intelligence office shall pay a license of sixteen dollars per quarter; *provided*, that no license shall be issued to any person to keep an intelligence office until consent shall have been first obtained by such person to carry on said business from the Board of Supervisors.

(Resolution No. 3640 (third series), Board of Supervisors of City and County of San Francisco.)

Resolved, That the following form of receipt required to be given by all employment offices in this city and county for moneys paid for assistance to obtain employment therein be and is hereby adopted by this Board, and any person or persons conducting the business of an employment office who shall fail, refuse, or neglect to use said form of receipt in the conduct of their business shall render themselves liable to a revocation of their license:

(Form of Receipt.)

Name of office ....

Address ....

Date ....

Name of person or persons to whom license was granted ....

Received from .... the sum of ...... dollars, for which we agree to furnish correct information by which .he shall be enabled to secure a situation as .... with ...., at .... street. Wages, $.... per month.

Failing to do which, we promise to refund the said sum of $...... on return of this receipt within two days, together with a written statement from the employer that the applicant could not get the situation. But the undersigned do not hold themselves responsible for any expenses incurred by the said .... should .he fail to obtain the situation above stated unless the information given .... at this office upon which .he acted and applied for said situation should have been found to have been incorrect.

Resolved, That the form of receipt for moneys paid for assistance to obtain employment outside this city and county, and identical with the foregoing is hereby adopted, except that for the words "two days" the words "ten days" are substituted, and the word "street" omitted.

JNO. A. RUSSELL, Clerk.

(Authority to issue licenses, see Stats. 1861, p. 412.)

Mechanics' Liens.

(Constitution of California, Article X.)

SEC. 15. Mechanics, material-men, artisans, and laborers of every class, shall have a lien upon the property upon which they have bestowed labor or furnished material, for the value of such labor done and material furnished; and the Legislature shall provide by law for the speedy and efficient enforcement of such liens.

Liens on Personal Property.

(Civil Code of California.)

SEC. 3051. Every person who, while lawfully in possession of an article of personal property, renders any service to the owner thereof, by labor or skill, employed for the protection, improvement, safekeeping, or carriage thereof, has a special lien thereon dependent on possession, for the compensation, if any, which is due to him from the owner for such service. * * *

SEC. 3052. A person who makes, alters, or repairs any article of personal property, at the request of the owner or legal possessor of the property, has a lien on the same for his reasonable charges for work done and materials furnished, and may retain possession of the same until the charges are paid. If not paid within two months after the

work is done, the person may proceed to sell the property at public auction, by giving ten days' public notice of the sale by advertising in some newspaper published in the county in which the work was done; or, if there be no newspaper published in the county, then by posting up notices of the sale in three of the most public places in the town where the work was done for ten days previous to the sale. The proceeds of the sale must be applied to the discharge of the lien and the cost of keeping and selling the property; the remainder, if any, must be paid over to the owner thereof.

Seamen's Liens for Wages.

(Civil Code of California.)

SEC. 3056. The mate and seamen of a ship have a general lien, independent of possession, upon the ship and freightage, for their wages, which is superior to every other lien.

Liens on Vessels.

(Code of Civil Procedure of California.)

SEC. 813. All steamers, vessels, and boats are liable:

1. For services rendered on board at the request of, or on contract with, their respective owners, masters, agents, or consignees;

* * * * * * * *

3. For work done or materials furnished in this State for their construction, repair, or equipment;

* * * * * * * *

6. Demands for these several causes constitute liens upon all steamers, vessels, and boats, and have priority in their order herein enumerated, and have preference over all other demands; but such liens only continue in force for the period of one year from the time the cause of the action accrued.

SEC. 814. Actions for any of the causes specified in the preceding section must be brought against the owners by name, if known, but if not known, that fact shall be stated in the complaint and the defendant shall be designated as unknown owners. Other persons having a lien upon the vessel may be made defendants to the action, the nature and amount of such lien being stated in the complaint.

SEC. 815. The complaint must designate the steamer, vessel, or boat, by name, and must be verified by the oath of the plaintiff, or some one on his behalf.

SEC. 816. The summons and copy of the complaint must be served on the owners if they can be found; otherwise, they may be served on the master, mate, or person having charge of the steamer, vessel, or boat.

SEC. 817. The plaintiff, at the time of issuing the summons, or at any time afterward, may have the steamer, vessel, or boat, with its tackle, apparel, and furniture, attached as security for the satisfaction of any judgment that may be recovered in the action.

SEC. 818. The clerk of the court must issue a writ of attachment, on the application of the plaintiff, upon receiving a written undertaking on behalf of the plaintiff, executed by two or more sufficient sureties, to the effect that if the judgment be rendered in favor of the owner of the steamer, vessel, or boat, as the case may be, he will pay all costs and damages that may be awarded against him, and all damages that may be sustained by him from the attachment, not exceeding the sum specified in the undertaking, which shall in no case be less than five hundred dollars.

SEC. 819. The writ must be directed to the Sheriff of the county within which the steamer, vessel, or boat lies, and direct him to attach such steamer, vessel, or boat, with its tackle, apparel, and furniture, and keep the same in his custody until discharged in due course of law.

SEC. 820. The Sheriff to whom the writ is directed and delivered must execute it without delay, and must attach and keep in his custody the steamer, vessel, or boat named therein, with its tackle, apparel, and furniture, until discharged in due course of law; but the Sheriff is not authorized by any such writ to interfere with the discharge of any merchandise on board of such steamer, vessel, or boat, or with the removal of any trunks or other property of passengers, or of the captain, mate, seaman, steward, cook, or other persons employed on board.

SEC. 824. If the attachment be not discharged, and a judgment be recovered in the action in favor of the plaintiff, and an execution be issued thereon, the Sheriff must sell at public auction, after publication of notice of such sale for ten days, the steamer, vessel, or boat, with its tackle, apparel, and furniture, or such interest therein as may be necessary, and must apply the proceeds of the sale as follows:

1. When the action is brought for demands other than the wages of mariners, boatmen, and others employed in the service of the steamer, vessel, or boat sold, to the payment of the amount of such wages, as specified in the execution;

2. To the payment of the judgment and costs, including his fees;

3. He must pay any balance remaining to the owner, or to the master, agent, or consignee who may have appeared on behalf of the owner; or, if there be no appearance, then into court, subject to the claim of any party or parties legally entitled thereto.

SEC. 825. Any mariner, boatman, or other person employed in the service of the steamer, vessel, or boat attached, who may wish to assert his claim for wages against the same, the attachments being issued for other demands than such wages, may file an affidavit of his claim, setting forth the amount and the particular service rendered, with the

clerk of the court; and thereafter no attachment can be discharged upon filing an undertaking, unless the amount of such claim, or the amount determined as provided in the next section, be covered thereby, in addition to the other requirements; and any execution issued against such steamer, vessel, or boat, upon judgment recovered thereafter, must direct the application of the proceeds of any sale:

1. To the payment of the amount of such claims filed, or the amount determined, as provided in the next section, which amount the clerk must insert in the writ;

2. To the payment of the judgment and costs, and Sheriff's fees, and must direct the payment of any balance to the owner, master, or consignee, who may have appeared in the action; but if no appearance by them be made therein, it must direct a deposit of the balance in court.

Mechanics' Liens.

(Code of Civil Procedure of California.)

Sec. 1183 (as amended by Chapter XXXV, Acts of 1899, p. 33). Mechanics, material-men, contractors, subcontractors, artisans, architects, machinists, builders, miners, and all persons and laborers of every class, performing labor upon or furnishing materials to be used in the construction, alteration, addition to, or repair, either in whole or in part, of any building, wharf, bridge, ditch, flume, aqueduct, well, tunnel, fence, machinery, railroad, wagon road, or other structure, shall have a lien upon the property upon which they have bestowed labor, or furnished materials, for the value of such labor done and materials furnished, whether at the instance of the owner or of any other person acting by his authority, or under him, as contractor or otherwise; and any person who performs labor in any mining claim or claims, has a lien upon the same, and the works owned and used by the owners for reducing the ores from such mining claim or claims, for the work or labor done, or materials furnished by each respectively, whether done or furnished at the instance of the owner of the building or other improvement, or his agent; and every contractor, subcontractor, architect, builder, or other person having charge of any mining, or of the construction, alteration, addition to, or repair, either in whole or in part, of any building or other improvement as aforesaid, shall be held to be the agent of the owner, for the purposes of this chapter. In case of a contract for the work, between the reputed owner and his contractor, the lien shall extend to the entire contract price, and such contract shall operate as a lien in favor of all persons, except the contractor, to the extent of the whole contract price; and after all such liens are satisfied, then as a lien for any balance of the contract price in favor of the contractor. All such contracts shall

be in writing when the amount agreed to be paid thereunder exceeds one thousand dollars, and shall be subscribed by the parties thereto, and the said contract, or a memorandum thereof, setting forth the names of all the parties to the contract, a description of the property to be affected thereby, together with a statement of the general character of the work to be done, the total amount to be paid thereunder, and the amounts of all partial payments, together with the times when such payments shall be due and payable, shall, before the work is commenced, be filed in the office of the County Recorder of the county, or city and county, where the property is situated, who shall receive one dollar for such filing; otherwise they shall be wholly void, and no recovery shall be had thereon by either party thereto; and in such case, the labor done and materials furnished by all persons aforesaid, except the contractor, shall be deemed to have been done and furnished at the personal instance of the owner, and they shall have a lien for the value thereof.

Sec. 1184 (as amended by Chapter CXXXVII, Acts of 1887). No part of the contract price shall, by the terms of any such contract, be made payable, nor shall the same nor any part thereof be paid in advance of the commencement of the work, but the contract price shall, by the terms of the contract, be made payable in installments at specified times after the commencement of the work, or on the completion of specified portions of the work, or on completion of the whole work; *provided*, that at least twenty-five per cent of the whole contract price shall be made payable at least thirty-five days after the final completion of the contract. No payment made prior to the time when the same is due, under the terms and conditions of the contract, shall be valid for the purpose of defeating, diminishing, or discharging any lien in favor of any person, except the contractor, but as to such liens, such payment shall be deemed as if not made, and shall be applicable to such liens, notwithstanding that the contractor to whom it was paid may thereafter abandon his contract, or be or become indebted to the reputed owner in any amount, for damages or otherwise, for non-performance of his contract or otherwise. As to all liens, except that of the contractor, the whole contract price shall be payable in money, and shall not be diminished by any prior or subsequent indebtedness, offset, or counterclaim, in favor of the reputed owner and against the contractor; no alteration of any such contract shall affect any lien acquired under the provisions of this chapter. In case such contracts and alterations thereof do not conform substantially to the provisions of this section, the labor done and materials furnished, by all persons except the contractor, shall be deemed to have been done and furnished at the personal instance and request of the person who contracted with the contractor, and they shall have a lien for the value thereof. Any of the persons mentioned in section eleven hundred and eighty-three,

except the contractor, may at any time give to the reputed owner a written notice that they have performed labor or furnished materials, or both, to the contractor, or other person acting by the authority of the reputed owner, or that they have agreed to do so, stating in general terms the kind of labor and materials, and the name of the person to or for whom the same was done, or furnished, or both, and the amount in value, as near as may be, of that already done or furnished, or both, and of the whole agreed to be done or furnished, or both. Such notice may be given by delivering the same to the reputed owner personally, or by leaving it at his residence, or place of business, with some person in charge, or by delivering it to his architects, or by leaving it at their residence, or place of business, with some person in charge, or by posting it in a conspicuous place upon the mining claim or improvement. No such notice shall be invalid by reason of any defect of form; *provided*, it is sufficient to inform the reputed owner of the substantial matters herein provided for, or to put him upon inquiry as to such matters. Upon such notice being given, it shall be the duty of the person who contracted with the contractor to, and he shall, withhold from his contractor, or from any other person acting under such reputed owner, and to whom by said notice the said labor or materials, or both, have been furnished, or agreed to be furnished, sufficient money due, or that may become due, to such contractor, or other person, to answer such claim and any lien that may be filed therefor for record under this chapter, including counsel fees not exceeding one hundred dollars in each case, besides reasonable costs provided for in this chapter.

Sec. 1185. The land upon which any building, improvement, well, or structure is constructed, together with a convenient space about the same, or so much as may be required for the convenient use and occupation thereof, to be determined by the court on rendering judgment, is also subject to the lien, if, at the commencement of the work, or of the furnishing of the materials for the same, the land belonged to the person who caused said building, improvement, well, or structure to be constructed, altered, or repaired, but if such person owned less than a fee simple estate in such land, then only his interest therein is subject to such lien.

Sec. 1186. The liens provided for in this chapter are preferred to any lien, mortgage, or other incumbrance which may have attached subsequent to the time when the building, improvement, or structure was commenced, work done, or materials were commenced to be furnished; also to any lien, mortgage, or other incumbrance of which the lienholder had no notice, and which was unrecorded at the time the building, improvement, or structure was commenced, work done, or the materials were commenced to be furnished.

Sec. 1187 (amendment approved March 27, 1897; Stats. 1897, p. 202.

This section was also amended in 1887; Stats. 1887, p. 152.) * * * Every original contractor, at any time after the completion of his contract, and until the expiration of sixty days after the filing of said notice of completion or notice of cessation of labor by the owner, and every person, save the original contractor, claiming the benefit of this chapter at any time after the completion of any building, improvement, or structure, or of the alteration, addition to, or repair thereof, and until the expiration of thirty days after the filing of said notice of completion or cessation by said owner, or within thirty days after the performance of any labor in a mining claim, must file for record with the County Recorder of the county, or city and county, in which such property or some part thereof is situated, a claim containing a statement of his demand, after deducting all just credits and offsets, with the name of the owner or reputed owner, if known, and also the name of the person by whom he was employed, or to whom he furnished the materials, with a statement of the terms, time given, and conditions of his contract, and also a description of the property to be charged with the lien, sufficient for identification, which claim must be verified by the oath of himself or some other person; *provided, however*, that in any event all claims of lien must be filed within ninety days after the completion of said building, improvement, or structure, or the alteration, addition to, or repair thereof. Any trivial imperfection in the said work or in the construction of any building, improvement, or structure, or of the alteration, addition to, or repair thereof, shall not be deemed such a lack of completion as to prevent the filing of any lien; and in all cases the occupation or use of a building, improvement, or structure, by the owner or his representative, or the acceptance by said owner or his agent of said building, improvement, or structure, and cessation from labor for thirty days upon any contract or upon any building, improvement, or structure, or the alteration, addition to, or repair thereof, shall be deemed equivalent to a completion thereof for all the purposes of this chapter.

Sec. 1188. In every case in which one claim is filed against two or more buildings, mining claims, or other improvements owned by the same person, the person filing such claim must at the same time designate the amount due to him on each of such buildings, mining claims, or other improvements; otherwise, the lien of such claim is postponed to other liens. The lien of such claimant does not extend beyond the amount designated as against other creditors having liens, by judgment, mortgage, or otherwise, upon either of such buildings or other improvements, or upon the land upon which the same are situated.

Sec. 1189. The recorder must record the claim in a book kept by him for that purpose, which record must be indexed as deeds and other conveyances are required by law to be indexed, and for which he may

receive the same fees as are allowed by law for recording deeds and other instruments.

Sec. 1190. No lien provided for in this chapter binds any building, mining claim, improvement, or structure for a longer period than ninety days after the same has been filed, unless proceedings be commenced in a proper court within that time to enforce the same; or, if a credit be given, then ninety days after the expiration of such credit; but no lien continues in force for a longer time than two years from the time the work is completed, by any agreement to give credit.

Sec. 1191 (as amended by Chapter CXXXVII, Acts of 1887). Any person who, at the request of the reputed owner of any lot in any incorporated city or town, grades, fills in, or otherwise improves the same, or the street or sidewalk in front of or adjoining the same, or constructs any areas, or vaults, or cellars, or rooms, under said sidewalks, or makes any improvements in connection therewith, has a lien upon said lot for his work done and materials furnished.

Sec. 1192. Every building or other improvement mentioned in section eleven hundred and eighty-three of this Code, constructed upon any lands with the knowledge of the owner, or the persons having or claiming any interest therein, shall be held to have been constructed at the instance of such owner or person having or claiming any interest therein, and the interest owned or claimed shall be subject to any lien filed in accordance with the provisions of this chapter, unless such owner or person having or claiming an interest therein shall, within three days after he shall have obtained knowledge of the construction, alteration, or repair, or the intended construction, alteration, or repair, give notice that he will not be responsible for the same, by posting a notice in writing to the effect, in some conspicuous place upon said land, or upon the building or other improvement situated thereon.

Sec. 1193. The contractor shall be entitled to recover upon a lien filed by him, only such amount as may be due to him according to the terms of his contract, after deducting all claims of other parties for work done and materials furnished, as aforesaid; and in all cases where a lien shall be filed, under this chapter, for work done or materials furnished to any contractor, he shall defend any action brought thereupon at his own expense; and during the pendency of such action, the owner may withhold from the contractor the amount of money for which lien is filed, and in case of judgment against the owner or his property, upon the lien, the said owner shall be entitled to deduct from any amount due or to become due by him to the contractor the amount of such judgment and costs, and if the amount of such judgment and costs shall exceed the amount due by him to the contractor, or if the owner shall have settled with the contractor in full, he shall be entitled to recover back from the contractor any amount so paid by him, the

said owner, in excess of the contract price, and for which the contractor was originally the party liable.

SEC. 1194. In every case in which different liens are asserted against any property, the court in the judgment must declare the rank of each lien, or class of liens, which shall be in the following order, viz:

1. All persons performing manual labor in, on, or about the same;
2. Persons furnishing materials;
3. Subcontractors;
4. Original contractors.

And the proceeds of the sale of the property must be applied to each lien or class of liens in the order of its rank; and whenever, in the sale of the property subject to the lien, there is a deficiency of proceeds, judgment may be docketed for the deficiency in like manner and with like effect as in actions for the foreclosure of mortgages.

SEC. 1195. Any number of persons claiming liens may join in the same action, and when separate actions are commenced, the court may consolidate them. The court must also allow, as a part of the costs, the money paid for filing and recording the lien, and reasonable attorney's fees in the Superior and Supreme Courts, such costs and attorney's fees to be allowed each lien claimant whose lien is established, whether he be plaintiff or defendant, or whether they all join in one action or separate actions are consolidated.

SEC. 1196. Whenever materials shall have been furnished for use in the construction, alteration, or repair of any building or other improvement, such materials shall not be subject to attachment, execution, or other legal process, to enforce any debt due by the purchaser of such materials, except a debt due for the purchase money thereof, so long as in good faith the same are about to be applied to the construction, alteration, or repair of such building, mining claim, or other improvement.

SEC. 1197. Nothing contained in this chapter shall be construed to impair or affect the right of any person to whom any debt may be due for work done, or materials furnished, to maintain a personal action to recover such debt against the person liable therefor.

SEC. 1200. In case the contractor shall fail to perform his contract in full, or shall abandon the same before completion, the portion of the contract price applicable to the liens of other persons than the contractor shall be fixed as follows: From the value of the work and materials already done and furnished at the time of such failure or abandonment, including materials then actually delivered or on the ground, which shall thereupon belong to the owner, estimated as near as may be by the standard of the whole contract price, shall be deducted the payments then due and actually paid, according to the terms of the contract and the provisions of sections eleven hundred and

eighty-three and eleven hundred and eighty-four, and the remainder shall be deemed the portion of the contract price applicable to such liens.

SEC. 1201. It shall not be competent for the owner and contractor, or either of them, by any term of their contract, or otherwise, to waive, affect, or impair the claims and liens of other persons, whether with or without notice, except by their written consent, and any term of the contract to that effect shall be null and void.

SEC. 1202. Any person who shall willfully give a false notice of his claim to the owner, under the provisions of section eleven hundred and eighty-four, shall forfeit his lien. Any person who shall willfully include in his claim, filed under section eleven hundred and eighty-seven, work or materials not performed upon or furnished for the property described in the claim, shall forfeit his lien. If the owner and his contractor shall directly or indirectly conspire to or agree that the written contract filed shall appear to show the contract price to be less than it really is, and it shall accordingly so show, then such contract shall be wholly void, and no recovery shall be had thereon by either party thereto, and in such case the labor done and materials furnished by all persons, except the contractor, shall be deemed to have been done and furnished at the personal instance of the owner, and they shall have a lien for the value thereof.

SEC. 1203 (as amended by Chapter CLXXI, Acts of 1893). Every contract required to be filed under the provisions of this chapter shall be accompanied by a good and sufficient bond in an amount equal to at least twenty-five per cent of the contract price, which said bond shall be filed at the same time and in the same manner as herein provided for the filing of such contract, or memorandum thereof. Said bond shall, by its terms, be made to inure to the benefit of any and all persons who perform labor for, or furnish materials to the contractor, or any person acting for him, or by his authority; and any such person shall have an action to recover upon said bond, against the principal and sureties, or either of them, for the value of such labor or materials, or both, not exceeding the amount of the bond; but such action shall not affect his lien, nor any action to foreclose the same, except that there shall be but one satisfaction of his claim, with costs and counsel fees. Any failure to comply with the provision of this section shall render the owner and contractor jointly and severally liable in damages to any and all material-men, laborers, and subcontractors entitled to liens upon the property affected by said contract.

Wages Preferred—In Assignments, Administration, Etc.

(Code of Civil Procedure of California.)

SEC. 1204 (as amended by Chapter LXXXII, Acts of 1893). In all assignments of property made by any person to trustees or assignees, on account of the inability of the person, at the time of the assignment, to pay his debts, or in proceedings in insolvency, the wages and salaries of miners, mechanics, salesmen, servants, clerks, laborers employed by such person, or any other person who renders services or performs work to the amount of one hundred dollars each, and for services rendered within sixty days previously, are preferred claims, and must be paid by such trustees or assignees before any other creditor or creditors of the assignor.

SEC. 1205 (as amended by Chapter LXXXI, Acts of 1893). In case of the death of any employer, the wages of each miner, mechanic, salesman, clerk, servant, laborer, or any other person who renders services or performs work, for services rendered within the sixty days next preceding the death of the employer, not exceeding one hundred dollars, rank in priority next after the funeral expenses, the expenses of the last sickness, the charges and expenses of administering upon the estate, and the allowance to the widow and infant children, and must be paid before other claims against the estate of the deceased person.

Wages Preferred—In Executions, Attachments, Etc.

(Code of Civil Procedure of California.)

SEC. 1206 (as amended by Chapter LXXVII, Acts of 1893). In cases of executions, attachments, and writs of similar nature, issued against any person except for claims for labor done, any miners, mechanics, salesmen, servants, clerks, and laborers, or any person who renders services or performs work, who have claims against the defendant for labor done or work performed may give notice of their claims, and the amount thereof sworn to by the person making the claim, to the creditor and the officer executing either of such writs, at any time before the actual sale of property levied upon, or in the event of a levy upon money at any time before the transfer of such money under execution; and, unless such claim is disputed by the debtor or a creditor such officer must pay to such person, out of the proceeds of the sale, or in the event of a levy on money, out of such money, the amount each is entitled to receive for services rendered within the sixty days next preceding the levy of the writ, not exceeding one hundred dollars. If any or all of the claims so presented and claiming preference under this section are disputed by either the debtor or a creditor, the person

presenting the same must commence an action within ten days for the recovery thereof and must prosecute his action with due diligence or be forever barred from any claim or priority of payment thereof; and the officer shall retain possession of so much of the proceeds of the sale or money as may be necessary to satisfy such claim until the determination of such action; and in case judgment be had for the claim, or any part thereof, carrying costs, the costs taxable therein shall likewise be a preferred claim with the same rank as the original claim.

SEC. 1207 (new section, Stats. 1883, p. 47). The debtor or creditor intending to dispute a claim presented under the provisions of the last section shall, within ten days after receiving notice of such claim, serve upon the claimant and the officer executing the writ a statement in writing, verified by the oath of the debtor or the person disputing such claim, setting forth that no part of said claim, or not exceeding a sum specified, is justly due from the debtor to the claimant for services rendered within the sixty days next preceding the levy of the writ. If the claimant brings suit on a claim which is disputed in part only and fail to recover a sum exceeding that which was admitted to be due, he shall not recover costs, but costs shall be adjudged against him.

Liens of Artisans, Mechanics, and Others, upon Personal Property, for Services Rendered in Connection with Such Property.

(Civil Code of California.)

SEC. 3051 (as amended by Act of 1877–8, p. 89). Every person who, while lawfully in possession of an article of personal property, renders any service to the owner thereof by labor or skill employed for the protection, improvement, safekeeping, or carriage thereof, has a special lien thereon, dependent on possession, for the compensation, if any, which is due to him from the owner for such service. And livery or boarding or feed stable proprietors and persons pasturing horses or stock have a lien dependent on possession for their compensation in caring for, boarding, feeding, or pasturing such horses or stock.

SEC. 3052. A person who makes, alters, or repairs any article of personal property, at the request of the owner, or legal possessor of the property, has a lien on the same for his reasonable charges for work done and materials furnished, and may retain possession of the same until the charges are paid. If not paid within two months after the work is done, the person may proceed to sell the property at public auction, by giving ten days' public notice of the sale by advertising in some newspaper published in the county in which the work was done; or, if there be no newspaper published in the county, then by posting up notices of the sale in three of the most public places in the town

where the work was done, for ten days previous to the sale. The proceeds of the sale must be applied to the discharge of the lien and the cost of keeping and selling the property; the remainder, if any, must be paid over to the owner thereof.

Laborers' Liens on Logs, Etc.

(Stats. of Cal. 1877–8, p. 747. Act approved March 30, 1878.)

Section 1 (as amended Stats. of Cal. 1880, p. 38). A person who labors at cutting, hauling, rafting, or driving logs or lumber, or who performs any labor in or about a logging camp necessary for the getting out or transportation of logs or lumber, shall have a lien thereon for the amount due for his personal services, which shall take precedence of all other claims, to continue for thirty days after the logs or lumber arrive at the place of destination, for sale or manufacture, except as hereinafter provided.

Sec. 2. The lien hereby created shall cease and determine unless the claimant thereof shall within twenty days from the time such labor shall have been completed, file and record in the office of County Recorder of the county where such labor was performed a verified claim, containing a statement:

1. Of his demand, after deducting all just credits and offsets;
2. The time within which such labor was done;
3. The name of the person or persons for which the same was done;
4. The place where the logs or timber upon which such lien is claimed are believed to be situated, and the marks upon the same;
5. The reputed owner thereof; and,
6. The reputed owner of the land from which the same were cut and hauled.

Sec. 3 (as amended Stats. of Cal. 1880, p. 38). All liens hereby provided for shall cease and determine unless suit to foreclose the same shall be commenced in the proper court within twenty-five days from the time the same are filed.

Sec. 4. The plaintiff in any such suit, at the time of issuing the summons, or at any time afterward, may have the logs or timber upon which such lien subsists attached, as further security for the payment of any judgment he may recover, unless defendant give him good and sufficient security to pay such judgment, in which event such logs shall be forthwith discharged by the Sheriff from such attachment, and from the lien hereby created.

Sec. 5. The clerk of the court must issue the writ of attachment upon receiving an affidavit by or on behalf of the plaintiff, showing:

1. That the defendant is indebted to the plaintiff upon a demand for

labor, for which his claim has been duly filed in accordance with section two of this Act;

2. That the sum for which the attachment is asked is an actual bona fide existing debt, due and owing from the defendant to the plaintiff, and that the attachment is not sought, and the action is not prosecuted, to hinder, delay, or defraud any creditor or creditors of the defendant.

Sec. 6. The writ must be directed to the Sheriff of the county, and must require him to attach and safely keep the logs and timber specified in such lien, or so much thereof as may be sufficient to satisfy plaintiff's demand, unless the defendant give good and sufficient security, as provided in this Act, in which case, to take such security and discharge any attachment he may have made, and to deliver up such logs to the defendant, who shall receive the same free from the lien upon which suit is brought.

Sec. 7 (as amended Stats. of Cal. 1887, p. 53). Sections five hundred and thirty-nine, eleven hundred and eighty-nine, eleven hundred and ninety-one, eleven hundred and ninety-seven, eleven hundred and ninety-eight, and eleven hundred and ninety-nine, of the Code of Civil Procedure, are hereby made applicable to this Act.

Sec. 8. Such attachment shall be made by taking such logs into possession, and the Sheriff shall make an inventory and return of his proceedings as directed in Chapter IV, Title VII, of the Code of Civil Procedure.

Sec. 9. The lien provided for by this Act shall in no case extend beyond the limits of the county in which the logs or timber in controversy were cut.

Laborers' Liens on Threshing-Machines.

(Stats. of Cal. 1885, p. 109. Act approved March 12, 1885.)

Section 1. Every person performing work or labor of any kind in, with, about, or upon any threshing-machine, the engine, horse-power, wagons, or appurtenances thereof, while engaged in threshing, shall have a lien upon the same to the extent of the value of his services.

Sec. 2. The lien herein given shall extend for ten days after the person has ceased such work or labor.

Sec. 3. If judgment shall be recovered in any action to recover for said services for work or labor performed, and said property shall be sold, the proceeds of such sale shall be distributed pro rata to all judgment creditors who have, within ten days, begun suits to recover judgments for the amount due them for such work.

Sec. 4. The liens shall expire unless a suit to recover the amount of the claim is brought within ten days after the party ceases work.

Mine Regulations.

(Stats. of Cal. 1871-2, p. 413. Act of March 13, 1872.)

SECTION 1. It shall not be lawful for any corporation, association, owner, or owners, of any quartz mining claims within the State of California where such corporation, association, owner, or owners employ twelve men daily, to sink down into such mine or mines any perpendicular shaft or incline beyond a depth from the surface of three hundred feet without providing a second mode of egress from such mine, by shaft or tunnel, to connect with the main shaft at a depth of not less than one hundred feet from the surface.

SEC. 2. It shall be the duty of each corporation, association, owner, or owners of any quartz mine or mines in this State, where it becomes necessary to work such mines beyond the depth of three hundred feet, and where the number of men employed therein shall be twelve or more, to proceed to sink another shaft or construct a tunnel so as to connect with the main working shaft of such mine as a mode of escape from underground accidents or otherwise. And all corporations, associations, owner, or owners of mines as aforesaid, working at a greater depth than three hundred feet, not having any other mode of egress than from the main shaft, shall proceed as herein provided.

SEC. 3. When any corporation, association, owner, or owners of any quartz mine in this State shall fail to provide for the proper egress as herein contemplated, and where any accidents shall occur or any miner working therein shall be hurt or injured, and from such injury might have escaped if the second mode of egress had existed, such corporation, association, owner, or owners of the mine where the injury shall have occurred shall be liable to the person injured in all damages that may accrue by reason thereof; and an action at law in a court of competent jurisdiction may be maintained against the owner or owners of such mine, which owners shall be jointly or severally liable for such damages. And where death shall ensue from injuries received from any negligence on the part of the owners thereof, by reason of their failure to comply with any of the provisions of this Act, the heirs or relatives surviving the deceased may commence an action for the recovery of such damages. * * *

(Stats. of Cal. 1873-4, p. 726. Act of March 27, 1874.)

SECTION 1. The owner or agent of every coal mine shall make or cause to be made an accurate map or plan of the workings of such coal mine, on a scale of one hundred feet to the inch.

SEC. 2. A true copy of which map or plan shall be kept at the office of the owner or owners of the mine, open to the inspection of all persons, and one copy of such map or plan shall be kept at the mine by

the agent or other person having charge of the mine, open to the inspection of the workmen.

Sec. 3. The owner or agent of every coal mine shall provide at least two shafts, or slopes, or outlets, separated by a natural strata of not less than one hundred and fifty feet in breadth, by which shafts, slopes, or outlets distinct means of ingress and egress are always available to the persons employed in the coal mines; *provided*, that if a new tunnel, slope, or shaft will be required for the additional opening, work upon the same shall commence immediately after the passage of this Act, and continue until its final completion, with reasonable dispatch.

Sec. 4. The owner or agent of every coal mine shall provide and establish for every such mine an adequate amount of ventilation, of not less than fifty-five cubic feet per second of pure air, or thirty-three hundred feet per minute, for every fifty men at work in such mine, and as much as circumstances may require, which shall be circulated through to the face of each and every working place throughout the entire mine, to dilute and render harmless and expel therefrom the noxious, poisonous gases to such an extent that the entire mine shall be in a fit state for men to work therein, and be free from danger to the health and lives of the men by reason of said noxious and poisonous gases, and all workings shall be kept clear of standing gas.

Sec. 5. To secure the ventilation of every coal mine, and provide for the health and safety of the men employed therein, otherwise and in every respect, the owner, or agent, as the case may be, in charge of every coal mine, shall employ a competent and practical inside overseer, who shall keep a careful watch over the ventilating apparatus, over the air-ways, the traveling-ways, the pumps and sumps, the timbering, to see as the miners advance in their excavations that all loose coal, slate, or rock overhead is carefully secured against falling; over the arrangements for signaling from the bottom to the top, and from the top to the bottom of the shaft or slope, and all things connected with and appertaining to the safety of the men at work in the mine. He, or his assistants, shall examine carefully the workings of all mines generating explosive gases, every morning before the miners enter, and shall ascertain that the mine is free from danger, and the workmen shall not enter the mine until such examination has been made and reported, and the cause of danger, if any, be removed.

Sec. 6. The overseer shall see that the hoisting machinery is kept constantly in repair and ready for use, to hoist the workmen in and out of the mine.

Sec. 7. The word "owner" in this Act shall apply to lessee as well.

Sec. 8. For any injury to person or property occasioned by any violation of this Act, or any willful failure to comply with its provisions, a right of action shall accrue to the party injured for any

direct damages he or she may have sustained thereby, before any court of competent jurisdiction.

Sec. 9. For any willful failure or negligence on the part of the overseer of any coal mine, he shall be liable to conviction of misdemeanor, and punished according to law; *provided*, that if such willful failure or negligence is the cause of the death of any person, the overseer, upon conviction, shall be deemed guilty of manslaughter.

Sec. 10. All boilers used for generating steam in and about coal mines shall be kept in good order, and the owner or agent thereof shall have them examined and inspected by a competent boilermaker, as often as once in three months.

Sec. 11. This Act shall not apply to opening a new coal mine.

Hospital for Miners.

(Stats. of Cal. 1881, p. 81. Act of March 14, 1881.)

Section 1. There shall be erected, as soon as conveniently may be, upon some suitable site, * * * a public hospital and asylum for the reception, care, medical and surgical treatment, and relief of the sick, injured, disabled, and aged miners, which shall be known as the "California State Miners' Hospital and Asylum."

* * * * * * * * *

Sec. 5. Indigent miners shall be charged for medical attendance, surgical operations, board, and nursing while residents in the hospital and asylum, no more than the actual cost; paying patients whose friends can pay their expenses, and who are not chargeable upon townships and counties, shall pay according to the terms directed by the trustees.

Sec. 6. The several Boards of Supervisors of counties, or any constituted authority in the State having care and charge of any indigent sick or aged person or persons, if satisfactorily proven by them to have been miners, shall have authority to send to the California State Miners' Hospital and Asylum such persons, and they shall be severally chargeable with the expenses of the care, maintenance and treatment, and removal to and from the hospital and asylum of such patients.

Protection of Miners—Mine Bell Signals.

(Stats. of Cal. 1893, p. 82.)

Section 1. Every person, company, corporation, or individual, operating any mine within the State of California—gold, silver, copper, lead, coal, or any other metal or substance where it is necessary to use

signals by means of bells or otherwise, for shafts, inclines, drifts, cross-cuts, tunnels, and underground workings—shall, after the passage of this bill, adopt, use, and put in force the following system or code of mine bell signals, as follows:

1 bell, to hoist. (See rule 2.)
1 bell, to stop if in motion.
2 bells, to lower. (See rule 2.)
3 bells, man to be hoisted; run slow. (See rule 2.)
4 bells, start pump if not running, or stop pump if running.
1——3 bells, start or stop air-compressor.
5 bells, send down tools. (See rule 4.)
6 bells, send down timbers. (See rule 4.)
7 bells, accident; move bucket or cage by verbal orders only.
1——4 bells, foreman wanted.
2——1——1 bells, done hoisting until called.
2——1——2 bells, done hoisting for the day.
2——2——2 bells, change buckets from ore to water, or *vice versa.*
3——2——1 bells, ready to shoot in the shaft. (See rule 3.)

Engineer's signal, that he is ready to hoist, is to raise the bucket or cage two feet and lower it again. (See rule 3.)

Levels shall be designated and inserted in notice hereinafter mentioned. (See rule 5.)

SEC. 2. For the purpose of enforcing and properly understanding the above code of signals, the following rules are hereby established:

Rule 1. In giving signals make strokes on bell at regular intervals. The bar (——) must take the same time as for one stroke of the bell and no more. If timber, tools, the foreman, bucket, or cage, are wanted to stop at any level in the mine, signal, by number of strokes on the bell, the number of the level first before giving the signal for timber, tools, etc. Time between signals to be double bars (—— ——). Examples:

6—— ——5, would mean stop at sixth level with tools.

4—— ——1——1——1—— ——1, would mean to stop at fourth level, man on, hoist.

2—— ——1——4, would mean stop at second level with foreman.

Rule 2. No person must get off or on the bucket or cage while the same is in motion. When men are to be hoisted, give the signal for men. Men must then get on bucket or cage, then give the signal to hoist. Bell cord must be in reach of man on the bucket or cage at station.

Rule 3. After signal "ready to shoot in shaft," engineer must give his signal when he is ready to hoist. Miners must then give the signal of "men to be hoisted," then "spit fuse," get into the bucket, and give the signal to hoist.

Rule 4. All timbers, tools, etc., "longer than the depth of the bucket," to be hoisted or lowered, must be securely lashed at the upper end to the cable. Miners must know they will ride up or down the shaft without catching on rocks or timbers and be thrown out.

Rule 5. The foreman will see that one printed sheet of these signals and rules for each level and for the engine-room are attached to a board not less than twelve inches wide by thirty-six inches long, and securely fasten the board up where signals can be easily read at the places above stated.

Rule 6. The above signals and rules must be obeyed. Any violation will be sufficient grounds for discharging the party or parties so doing. No person, company, corporation, or individuals operating any mine within the State of California, shall be responsible for accidents that may happen to men disobeying the above rules and signals. Said notice and rules shall be signed by the person or superintendent having charge of the mine, who shall designate the name of the corporation or the owner of the mine.

Sec. 3. Any person or company failing to carry out any of the provisions of this Act shall be responsible for all damages arising to or incurred by any person working in said mine during the time of such failure.

Certain Employments of Children Forbidden.

(Stats. of Cal. 1877-8, p. 813. Act of March 30, 1878.)

Section 1. Any person, whether as a parent, relative, guardian, employer, or otherwise, having the care, custody, or control of any child under the age of sixteen years, who shall exhibit, use, or employ, or who shall in any manner or under any pretense sell, apprentice, give away, let out, or otherwise dispose of any such child to any person, under any name, title, or pretense, in or for the vocation, occupation, service, or purpose of singing, playing on musical instruments, rope or wire walking, dancing, begging, or peddling, or as a gymnast, acrobat, contortionist, or rider, in any place whatsoever, or for or in any obscene, indecent, or immoral purpose, exhibition, or practice whatsoever, or for or in any mendicant or wandering business whatsoever, or for or in any business, exhibition, or vocation injurious to the health or dangerous to the life or limb of such child, or who shall cause, procure, or encourage any such child to engage therein, shall be guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than fifty nor more than two hundred and fifty dollars, or by imprisonment in the county jail for a term not exceeding six months, or by both such fine and imprisonment; *provided*, that nothing in this section contained shall apply to or affect the employment or use of any such child as a singer or mu-

sician in any church, school, or academy, or the teaching or learning of the science or practice of music; or the employment of any such child as a musician at any concert or other musical entertainment, on the written consent of the mayor of the city or the president of the board of trustees of the town where such concert or entertainment shall take place.

SEC. 2. Every person who shall take, receive, hire, employ, use, exhibit, or have in custody any child under the age and for any of the purposes mentioned in the preceding section shall be guilty of a like offense and punished by a like punishment as therein provided.

Hiring Out Minor Employes Unlawful in Certain Cases.

(Penal Code of California.)

SEC. 1389 (added by Chapter CIII, Acts of 1887). No minors in the employ of any telephone company, special delivery company, or association, or any other corporation, or person or persons, engaged in the delivery of packages, letters, notes, messages, or other matter, shall be assigned by such corporations, or person or persons, to hire such minors to the keepers of houses, variety theaters, or other places of questionable repute, or to other persons connected with such places of questionable repute, nor to permit them to enter such places of illegal or questionable calling. * * * This law shall apply alike to managers, superintendents, and agents of such corporations, and to be enforced against them. Any person violating the provisions of this Act shall be guilty of a misdemeanor.

Hours of Labor—Children.

(Penal Code of California.)

SEC. 651. Every person having a minor child under his control' either as a ward or as an apprentice, who, except in vinicultural or horticultural pursuits, or in domestic or household occupations, requires such child to labor more than eight hours in any one day, is guilty of a misdemeanor.

Employment, Hours of Labor, etc., of Children.

(Stats. of Cal. 1889, p. 4.)

SECTION 1. No minor under the age of eighteen shall be employed in laboring in any manufacturing, mechanical, or mercantile establishment, or other place of labor, more than ten hours in one day, except when it is necessary to make repairs to prevent the interruption of the

ordinary running of the machinery, or when a different apportionment of the hours of labor is made for the sole purpose of making a shorter day's work for one day of the week; and in no case shall the hours of labor exceed sixty hours in a week.

Sec. 2. No child under ten years of age shall be employed in any factory, workshop, or mercantile establishment; and every minor under sixteen years of age when so employed shall be recorded by name in a book kept for the purpose, and a certificate (duly verified by his or her parent or guardian, or if the minor shall have no parent or guardian, then by such minor, stating age and place of birth of such minor), shall be kept on file by the employer, which book and which certificate shall be produced by him or his agent at the requirement of the Commissioner of the Bureau of Labor Statistics.

Sec. 3. Every person or corporation employing minors under sixteen years of age in any manufacturing establishment, shall post and keep posted in a conspicuous place in every room where such help is employed, a printed notice stating the number of hours per day for each day of the week required of such persons, and in every room where minors under sixteen years of age are employed, a list of their names, with their ages.

Sec. 4. Any person or corporation that knowingly violates or omits to comply with any of the foregoing provisions of this Act, or who knowingly employs or suffers or permits any minor to be employed, in violation thereof, shall, on conviction, be punished by a fine of not less than fifty nor more than two hundred (200) dollars for each and every offense.

Sec. 5. It shall be the duty of the Commissioner of the Bureau of Labor Statistics to enforce the provisions of this Act.

Wages of Minors—To Whom Payable.

(Civil Code of California.)

Sec. 212. The wages of a minor employed in service may be paid to him until the parent or guardian entitled thereto gives the employer notice that he claims such wages.

Registration, etc., of Plumbers.

(Stats. of Cal. 1883, p. 366.)

Section 1. Every master or journeyman plumber carrying on his trade shall, under such rules and regulations as the Board of Health of such county, or city and county, shall prescribe, register his name and

address at the health office of such county, or city and county; and after the said date it shall not be lawful for any person to carry on the trade of plumbing in any county, or city and county, unless his name and address is registered as above provided.

SEC. 2. A list of the registered plumbers shall be published in the yearly report of the health office.

(Stats. of Cal. 1887, p. 58. Act approved March 3, 1885.)

SECTION 1 (as amended by Chapter L, Acts of 1887). It shall not be lawful for any person to carry on business, or labor as a master or journeyman plumber in any incorporated city, or in any city and county in this State, until he shall have obtained from the board of health of said city, or city and county, a license authorizing him to carry on business, or labor as such mechanic. A license so to do shall be issued only after a satisfactory examination by the board of each applicant upon his qualifications to conduct such business or to so labor. All applications for license, and all licenses issued, shall state the name in full, age, nativity, and place of residence of the applicant or person so licensed. It shall be the duty of the secretary of each board of health to keep a record of all such licenses issued, together with an alphabetical index to the same.

SEC. 2 (as amended by Chapter L, Acts of 1887). A list of all licensed plumbers shall be published in the yearly report of the health officer of the board of health.[a]

Contract Work on Public Buildings Prohibited.

(Political Code of California.)

SEC. 3233. All work done upon the public buildings of this State must be done under the supervision of a superintendent, or State officer or officers having charge of the work, and all labor employed on such buildings, whether skilled or unskilled, must be employed by the day, and no work upon any of such buildings must be done by contract.

Hours of Labor on Public Work.

(Constitution of California, Article XX.)

SEC. 17. Eight hours shall constitute a legal day's work on all public work.

(Political Code of California.)

SEC. 3245. Eight hours' labor constitute a legal day's work in all cases where the same is performed under the authority of any law of

[a] See *Pasadena* vs. *Stimpson*, 91 Cal. 328.

this State, or under the direction, control, or by the authority of any officer of this State acting in his official capacity, or under the direction, control, or by the authority of any municipal corporation within this State, or of any officer thereof acting as such; and a stipulation to that effect must be made a part of all contracts to which the State or any municipal corporation therein is a party.[a]

(Stats. of Cal. 1899, p. 149.)

SECTION 1. The time of service of all laborers, workmen, and mechanics employed upon any public works of, or work done for, the State of California, or for any political subdivision thereof, whether said work is done by contract or otherwise, is hereby limited and restricted to eight hours in any one calendar day; and it shall be unlawful for any officer of the State, or of any political subdivision thereof, or any person acting for or on behalf thereof, or any contractor or subcontractor, for any part of any public works of, or work done for such State, or political subdivision thereof, or any person, corporation, or association whose duty it shall be to employ or to direct and control the services of such laborers, workmen, or mechanics, or who has, in fact, the direction or control of the services of such laborers, workmen, or mechanics, to require or permit them, or any of them, to labor more than eight hours in any one calendar day, except in cases of extraordinary emergency caused by fire, flood, or danger to life and property, or except to work upon public, military, or naval works or defenses in time of war.

SEC. 2. Each and every contract to which the State of California, or any political subdivision thereof, is a party, and every contract made for or on behalf of the said State or any political subdivision thereof, which contract may involve the employment of laborers, workmen, or mechanics, shall contain a stipulation that no laborer, workman, or mechanic in the employ of the contractor, or any subcontractor, doing or contracting to do any part of the work contemplated by the contract, shall be required or permitted to work more than eight hours in any one calendar day, except in cases of extraordinary emergency caused by fire, flood, or danger to life or property, or except to work upon public, military, or naval works or defenses in time of war; and each and every such contract shall stipulate a penalty for each violation of the stipulation directed by this Act of ten dollars for each laborer, workman, or mechanic, for each and every calendar day in which he shall labor more than eight hours; and the inspector or other officer or person whose duty it shall be to see that the provisions of any such contract are complied with, shall report to the proper officer of such State, or political subdivision thereof, all violations of the stipulation in this Act

[a] Held that contracts within the purview of the above cited section are not rendered invalid by failure to include therein the stipulation named. (*Babcock* vs. *Goodrich*, 47 Cal. 488.)

provided for in each and every such contract, and the amount of the penalties stipulated in any such contract shall be withheld by the officer or person whose duty it shall be to pay the moneys due under such contract, whether the violations for which said penalties were imposed were by the contractor, his agents or employés. No person on behalf of the State of California, or any political subdivision thereof, shall rebate or remit any penalty imposed under any stipulation herein provided for, unless upon a finding which he shall make up and certify that such penalty was imposed by reason of an error of fact. Nothing in this Act shall be construed to authorize the collection of said penalty from the State, or any political subdivision thereof.

Sec. 3. Any officer of the State of California, or any political subdivision thereof, or any person acting for or on behalf thereof, who shall violate the provisions of this Act, shall be deemed guilty of a misdemeanor, and be subject to a fine or imprisonment, or both, at the discretion of the court, the fine not to exceed five hundred dollars, nor the imprisonment one year.

Sec. 4. All Acts and parts of Acts inconsistent with this Act, in so far as they are inconsistent, are hereby repealed.

Sec. 5. This Act shall take effect and be in force from and after its passage.

Protection of Wages of Laborers on Public Works.

(Stats. of Cal. 1871-2, p. 951. Act of April 1, 1872.)

Section 1. Every person who employs laborers upon the public works, and who takes, keeps, or receives any part or portion of the wages due to such laborers from the State or municipal corporation for which such work is done, is guilty of a felony.

Minimum Rate of Compensation for Labor on Public Works.

(Stats. of Cal. 1897, p. 90.)

Section 1. The minimum compensation to be paid for labor upon all work performed under the direction, control, or by the authority of any officer of this State acting in his official capacity, or under the direction, control, or by the authority of any municipal corporation within this State, or of any officer thereof acting as such, is hereby fixed at two (2) dollars per day; and a stipulation to that effect must be made a part of all contracts to which the State, or any municipal corporation therein, is a party; *provided, however*, that this Act shall not apply to

persons employed regularly in any of the public institutions of the State, or any city, city and county, or county.

Sec. 2. This Act shall take effect immediately.[a]

How Claims of Material-men, Mechanics, and Laborers, Employed by Contractors upon State, Municipal, or Other Public Work, Shall be Secured.

(Stats. of Cal. 1897, p. 201.)

Section 1. Every contractor, person, company, or corporation, to whom is awarded a contract for the execution or performance of any building, excavating, or other mechanical work, for this State, or by any county, city and county, city, town, or district therein, shall, before entering upon the performance of such work, file with the commissioners, managers, trustees, officers, Board of Supervisors, Board of Trustees, Common Council, or other body by whom such contract was awarded, a good and sufficient bond, to be approved by such contracting body, officers, or board, in a sum not less than one half of the total amount payable by the terms of the contract; such bond shall be executed by the contractor, and at least two sureties, in an amount not less than the sum specified in the bond, and must provide that if the contractor, person, company, or corporation, fails to pay for any materials or supplies furnished for the performance of the work contracted to be done, or for any work or labor done thereon of any kind, that the sureties will pay the same, in an amount not exceeding the sum specified in the bond; *provided*, that such claims shall be filed as hereinafter required.

Sec. 2. Any material-man, person, company, or corporation, furnishing materials or supplies used in the performance of the work contracted to be executed or performed, or any person who performs work or labor upon the same, or any person who supplies both work and materials, and whose claim has not been paid by the contractor, company, or corporation, to whom the contract has been awarded, shall, within thirty days from the time such work is completed, file with the commissioners, managers, trustees, officers, Board of Supervisors, Board of Trustees, Common Council, or other body by whom such contract was awarded, the verified statement of such claims, together with a statement that the same has not been paid. At any time within ninety days after the filing of such claim, the person, company, or corporation filing the same may commence an action against the sureties on the bond, specified and required by section one hereof.

Sec. 3. This Act shall take effect immediately.

[a] Held that contracts within the purview of the above-cited Act relative to minimum wages per day to be paid for labor upon public work are not rendered invalid by failure to include therein the stipulation named. (*Babcock* vs. *Goodrich*, 47 Cal. 488.)

Securing Claims for Labor, etc., for Street and Sewer Work in Municipalities.

(Stats. of Cal. 1899, p. 23.)

SECTION 1. A new section, to be known as section six and one half of said Act, is hereby added thereto, and shall read as follows:

Section 6½. Every contractor, person, company, or corporation, including contracting owners, to whom is awarded any contract for street work under this Act, shall, before executing the said contract, file with the Superintendent of Streets a good and sufficient bond, approved by the Mayor, in a sum not less than one half of the total amount payable by the terms of said contract; such bond shall be executed by the principal and at least two sureties who shall qualify for double the sum specified in said bond, and shall be made to inure to the benefit of any and all persons, companies, or corporations who perform labor on, or furnish materials to be used in the said work of improvement, and shall provide that if the contractor, person, company, or corporation to whom said contract was awarded fails to pay for any materials so furnished for the said work of improvement, or for any work or labor done thereon of any kind, that the sureties will pay the same, to an amount not exceeding the sum specified in said bond. Any material-man, person, company, or corporation, furnishing material to be used in the performance of said work specified in said contract, or who performs work or labor upon the said improvement, whose claim has not been paid by the said contractor, company, or corporation, to whom the said contract was awarded, may, within thirty days from the time said improvement is completed, file with the Superintendent of Streets the verified statement of his or its claim, together with a statement that the same, or some part thereof, has not been paid. At any time within ninety days after the filing of such claim, the person, company, or corporation, filing the same, or their assigns, may commence an action on said bond for the recovery of the amount due on said claim, together with the costs incurred in said action, and a reasonable attorney fee, to be fixed by the court, for the prosecution thereof.

SEC. 2. This Act shall take effect and be in force from and after its passage.

Discharged Soldiers, Sailors, and Marines Preferred in Employment on Public Works.

(Stats. of Cal. 1891, p. 289.)

SECTION 1. In every department, upon all public works, whether under contract or not, in all offices, employments, places, and positions of trust or profit of this State, honorably discharged ex-Union soldiers, sailors, and marines of the War of the Rebellion must be preferred for

appointment, employment, and retention therein; and age, loss of limb, or other physical impairment, which does not, in fact, incapacitate, shall not be deemed to disqualify them; *provided*, they possess the capacity necessary to fill the position; and persons thus preferred, or appointed, unless appointed or employed for a definite statutory period, shall not be dismissed from such positions, offices, or employments, except upon charges, after a hearing, and for just cause.

Riots, Mobs, Etc.

(Penal Code of California.)

Sec. 731 (as amended by Chapter CLXX, Acts of 1895). Whenever any portion of the National Guard or enrolled militia shall have been called into active service to suppress an insurrection or rebellion, to disperse a mob, or to enforce the execution of the laws of the State or of the United States, the commanding officer shall use his own discretion with respect to the propriety of attacking or firing upon any mob or unlawful assembly; and his honest and reasonable judgment in the exercise of his duty shall be full protection, civilly and criminally, for any act or acts done while on duty. No officer who has been called out to sustain the civil authorities shall, under any pretense, or in compliance with any order, fire blank cartridges upon any mob or unlawful assemblage, under penalty of being cashiered by sentence of a court-martial.

Sex No Disqualification from Pursuing Labor.

(Constitution of California, Article XX.)

Sec. 18. No person shall, on account of sex, be disqualified from entering upon or pursuing any lawful business, vocation, or profession.

Sunday Labor—Bakers.

(Stats. of Cal. 1880, p. 80. Act of April 16, 1880.)

Section 1. It shall be unlawful for any person engaged in the business of baking to engage or permit others in his employ to engage in the labor of baking for the purpose of sale, between the hours of six P. M. on Saturday and six P. M. on Sunday, except in the setting of sponge preparatory to the night's work; *provided, however*, that restaurants, hotels, and boarding-houses may do such baking as is necessary for their own consumption.

Sec. 2. Any person violating the provisions of this Act shall be guilty

of a misdemeanor, and shall be punishable by imprisonment in the county jail not less than one month nor more than six months, or by a fine of not less than twenty-five nor more than two hundred dollars, or by both fine and imprisonment.[a]

Sunday Labor—Barbers.

(Penal Code of California.)

SEC. 310½ (added by Chapter CC, Acts of 1895). Every person who, as proprietor, manager, lessee, employé, or agent, keeps open or conducts, or causes to be kept open or conducted, any barber shop, bathhouse and barber shop, barber shop of a bathing establishment, or hair-dressing establishment, or any place for shaving or hair-dressing, used or conducted in connection with any other place of business or resort, or who engages at work or labor as a barber in any such shop or establishment on Sunday, or on a legal holiday, after the hour of twelve o'clock M. of the said day, is guilty of a misdemeanor.[b]

Day of Rest from Labor.

(Stats. of Cal. 1893, p. 54.)

SECTION 1. Every person employed in any occupation of labor shall be entitled to one day's rest therefrom in seven; and it shall be unlawful for any employer of labor to cause his employés, or any of them, to work more than six days in seven; *provided, however,* that the provisions of this section shall not apply to any case of emergency.

SEC. 2. For the purposes of this Act, the term day's rest shall mean and apply to all cases, whether the employé is engaged by the day, week, month, or year, and whether the work performed is done in the day or night time.

SEC. 3. Any person violating the provisions of this Act shall be deemed guilty of a misdemeanor.

Trademarks of Trade Unions, Etc.

(Political Code of California.)

SEC. 3200 (added by Chapter CL, Acts of 1887). Any trade union, labor association, or labor organization, organized and existing in this State, whether incorporated or not, may adopt and use a trademark and affix the same to any goods made, produced, or manufactured by the

[a] This Act was declared unconstitutional. (*Ex parte Westerfeld*, 55 Cal. 550.)
[b] Declared unconstitutional. (*Ex parte Jentzsch*, 113 Cal., p. 468.)

members of such trade union, labor association, or labor organization, or to the box, cask, case, or package containing such goods, and may record such trademark by filing or causing to be filed with the Secretary of State its claim to the same, and a copy or description of such trademark, with the affidavit of the president of such trade union, labor association, or labor organization, certified to by any officer authorized to take acknowledgments of conveyance, setting forth that the trade union, labor association, or labor organization of which he is the president is the exclusive owner or agent of the owner of such trademark. * * *

Sec. 3201 (added by Chapter CL, Acts of 1887). The president or other presiding officer of any trade union, labor association, or labor organization, organized and existing in this State, which shall have complied with the provisions of the preceding section, is hereby authorized and empowered to commence and prosecute in his own name any action or proceedings he may deem necessary for the protection of any trademark adopted or in use under the provisions of the preceding section, or for the protection or enforcement of any rights or powers which may accrue to such trade union, labor association, or labor organization, by the use or adoption of said trademark.

Wages of Employes of State Printing Office.

(Political Code of California.)

Sec. 531 (as amended by Stats. of Cal. 1895, p. 233). The duties of the Superintendent of State Printing shall be as follows: * * * He shall employ such compositors, pressmen, and assistants as the exigency of the work from time to time requires, and may at any time discharge such employés; *provided*, that at no time shall he pay said compositors, pressmen, or assistants, a higher rate of wages than is paid by those employing printers in Sacramento for the like work. He shall at no time employ more compositors or assistants than the absolute necessities of the State printing may demand, and he shall not permit any other than State work to be done in the State Printing Office. * * *

Corporations Shall Have Monthly Paydays for Employes.

(Stats. of Cal. 1897, p. 231.)

Section 1. Every corporation doing business in this State shall pay, at least once a month, each and every employé employed by such corporation, in transacting or carrying on its business, or in the performance of labor for it, the wages earned by such employé during the preceding month; *provided, however*, that if at the time of payment any

employé shall be absent, or not engaged in his usual employment, he shall be entitled to said payment at any time thereafter upon demand.

Sec. 2. Any violation of any of the provisions of section one of this Act shall entitle each of the said employés to a lien on all the property of said corporation for the amount of their wages, which lien shall take preference over all other liens, except duly recorded mortgages or deeds of trust; and in any action to recover the amount of such wages, or to enforce said lien, the plaintiff shall be entitled to a reasonable attorney's fee, to be fixed by the court and which shall form part of the judgment in said action, and shall also be entitled to an attachment against said property. An unrecorded deed shall be no defense to such actions.

Sec. 3. That on the trial of any action against such corporation for a violation of the provisions of this Act, such corporation shall not be allowed to set up any defense for a failure to pay monthly any employé engaged in transacting or carrying on its business the wages earned by such employé during the preceding month, other than the fact that such wages were not earned, except a valid assignment of such wages, a set-off, or counter-claim against the same, or the absence of such employé from his usual employment at the time of the payment of the wages so earned by him.

Sec. 4. No assignment of future wages, payable monthly under the provisions of this Act, shall be made to the corporation from which such wages are or may become due, to any person, on behalf of such corporation, for the purpose of evading the provisions of this Act, and all such assignments are hereby declared to be invalid.

Sec. 5. No corporation shall require, and no employé of such corporation shall make, any agreement to accept wages at longer periods than as provided in this Act as a condition of employment.

Sec. 6. All wages earned by any employé engaged in the service of any corporation in this State shall be paid in lawful moneys of the United States, or in checks negotiable at face value on demand.

Sec. 7. Any corporation violating any of the provisions of this Act shall be subject to a fine not exceeding one hundred dollars, or less than fifty dollars, for each violation, the same to be imposed by any court in this State having jurisdiction of offenses in which the penalty does not exceed a fine of one hundred dollars; said fine to be paid, by the judge or magistrate before whom a recovery may be had under the provisions of this Act, into the general fund of the treasury of the county in which said conviction may be had.

Sec. 8. This Act shall take effect and be in force from and after the first day of April, 1897.[a]

[a] Held unconstitutional in *Johnson* vs. *Goodyear Mining Co.*, 127 Cal., p. 4.

Cook Wagon and Camp Equipage, Department of Highways.

BIENNIAL REPORT

OF THE

DEPARTMENT OF HIGHWAYS

DECEMBER, 1900.

J. L. MAUDE,
COMMISSIONER.

SACRAMENTO:
A. J. JOHNSTON, : : : : SUPERINTENDENT STATE PRINTING.
1900.

State Capitol, Sacramento, California,
Department of Highways,
November 20, 1900.

To His Excellency Henry T. Gage,
Governor of the State of California:

Sir: I herewith transmit to you the Report of the Department of Highways, covering the work of the Department from May 25, 1899, to November 1, 1900, under authority of law; and, appended thereto, the Report of the Lake Tahoe State Wagon Road Commissioner.

Very respectfully,

J. L. MAUDE,
Highway Commissioner.

Attest: C. W. Vickrey, Secretary.

REPORT OF THE DEPARTMENT OF HIGHWAYS.

INTRODUCTORY.

ANCIENT ROADS.

Since mankind constructed society and became distributed over countries, roads have been a necessity. Although the Roman roads remain with us to-day as monuments to an empire that at one time had sway over the then known world, the Egyptians, the Israelites, and the Greeks preceded them in the construction of highways, and it remained for Carthage to build the first paved roads, connecting that great commercial city with Rome. All over the world, through Europe, Asia, and Africa, wherever the Roman legions went with the all-conquering eagle, they left in their wake a path of good roads.

The main Roman roads were designated by them as military highways, and connected the chief strategic points for the movements of an army, and it is a literal fact that during the time of the Cæsars "all roads led to Rome." In Italy, Switzerland, France, Germany, the British Isles, and other countries of Europe, vestiges of the old military highways of the Roman Empire still remain, and the engineering skill shown in traversing the lofty summits of the Alps and Pyrenees is well worthy of emulation by the modern road-builder.

Turning to our own continent, we find a most interesting account of the great roads of the Incas of Peru in the "History of the Conquest of Peru," by William H. Prescott. He says:

> Those who may discredit the accounts of (ancient) Peruvian industry will find their doubts removed on a visit to the country. The traveler still meets, especially in the central regions of the table-land, with memorials of the past, remains of temples, palaces, fortresses, terraced mountains, great military roads, aqueducts, and other public works, which, whatever degree of science they may display in their execution, astonish him by their number, the massive character of the materials, and the grandeur of the design. Among them, perhaps the most remarkable, are the great roads, the broken remains of which are still in sufficient preservation to attest their former magnificence. There were many of these roads, traversing different parts of the kingdom; but the most considerable were the two which extended from Quito to Cuzco, and, again diverging from the capital, continued in a southern direction toward Chili.
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> One of these roads passed over the grand plateau, and the other along the lowlands

on the borders of the ocean. The former was much the more difficult achievement, from the character of the country. It was conducted over pathless sierras buried in snow; galleries were cut for leagues through the living rock; rivers were crossed by means of bridges that swung suspended in the air; precipices were scaled by stairways hewn out of the native bed; ravines of hideous depth were filled up with solid masonry; in short, all the difficulties that beset a wild and mountainous region, and which might appall the most courageous engineer of modern times, were encountered and successfully overcome. The length of the road, of which scattered fragments only remain, is variously estimated, from fifteen hundred to two thousand miles; and stone pillars, in the manner of European milestones, were erected at stated intervals of somewhat more than a league, all along the route. Its breadth scarcely exceeded twenty feet. It was built of heavy flags of freestone, and in some parts, at least, covered with a bituminous cement, which time has made harder than the stone itself. In some places, where the ravines had been filled up with masonry, the mountain torrents, wearing on it for ages, have gradually eaten a way through the base, and left the superincumbent mass—such is the cohesion of the materials—still spanning the valley like an arch!

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The other great road of the Incas lay through the level country between the Andes and the ocean. It was constructed in a different manner, as demanded by the nature of the ground, which was for the most part low and much of it sandy. The causeway was raised on a high embankment of earth, and defended on either side by a parapet or wall of clay; and trees and odoriferous shrubs were planted along the margin, regaling the sense of the traveler with their perfumes, and refreshing him by their shades.

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The care of the great roads was committed to the districts through which they passed, and a large number of hands was constantly employed under the Incas to keep them in repair. This was the more easily done in a country where the mode of traveling was altogether on foot; though the roads are said to have been so nicely constructed, that a carriage might have rolled over them as securely as on any of the great roads of Europe. Still, in a region where the elements of fire and water are both actively at work in the business of destruction, they must, without constant supervision, have gradually gone to decay. Such has been their fate under the Spanish conquerors, who took no care to enforce the admirable system for their preservation adopted by the Incas. Yet, the broken portions that still survive, here and there, like the fragments of the great Roman roads scattered over Europe, bear evidence to their primitive grandeur, and have drawn forth the eulogium from a discriminating traveler, usually not too profuse in his panegyric, that "the roads of the Incas were among the most useful and stupendous works ever executed by man."

CONDITIONS IN CALIFORNIA.

During the eleven years from 1889 to 1899, inclusive, from data gathered by the Department of Highways, compiled from records in the various counties in the State, it is shown that the expenditures for road purposes were in excess of $18,500,000. This vast sum does not include expenditures upon the streets of municipalities and villages, nor does it include all of the payments for bridges, large parts of which have been paid for out of the County General Fund. Were the expenditures for all of these included in the road-tax, they would largely exceed the sum of $20,000,000; so that it may be assumed that the expenditures for road purposes in the State of California approximate $2,000,000 per annum.

To one conversant with the highways of this State it would seem unnecessary to intimate that, save in a few localities where roads are

naturally good, the condition of California roads is most deplorable. The systemless and makeshift manner of locating, constructing, and maintaining roads becomes evident to any one who travels them for any considerable period. Yet, the conditions prevailing in California are exceptionally favorable to road construction and maintenance. The geological, topographic, and climatic conditions cannot be surpassed in any other State. Severe freezing, which is the bane of road construction in other sections, is unknown (except in the highest altitudes), thus removing one of the great difficulties which generally confront road-builders. In almost every locality of the State, suitable material for macadamizing or otherwise surfacing roads is abundant. The valleys of the State generally permit of easy location for highways, and in the mountainous section of the State numerous passes facilitate the good location of roads. The main drawback in some sections is the lack of water for road-sprinkling, which, generally considered, is the most economic method of road maintenance in this State; but even this is overcome, especially in the southern section of the State, where the use of oil for this purpose is becoming general.

Thus, it will be seen that natural conditions generally favor highway construction in California. In addition to this, it is seen that large sums of money have been raised for and, presumably, expended upon the highways, while it is also seen that the mileage of roads in good condition within the State is infinitely small.

To the inquiring mind, the question at once suggests itself: Why does this state of affairs prevail? There can be but one answer: All work upon the highways within California has been conducted with but little method or system. Vast sums of money have been injudiciously and extravagantly expended. The methods, like the roads themselves, are full of ruts, from which it is difficult to turn out. There can be but one remedy: radical changes in these methods; and, until such radical changes have been inaugurated, the State of California can hope for no progress along this much-needed line of improvement.

The citizens of California, and not alone of California, but of the entire United States, have begun to appreciate that, while the State and Nation have made vast strides in civilization and industrial wealth, yet, with all of this progress, there has been absolute retrogression in highway construction.

HISTORY OF ROAD-BUILDING IN THE UNITED STATES.

In connection with the above, it would be interesting to note something of the history of road-building in the United States. In but few particulars will the same history of other great civilized nations resemble that of our country. Had the energy of the Roman Empire, when at its zenith of power, or the industry of the Incas, before the con-

quest of Peru, been transferred to the United States, this country would have been linked together to-day with a system of magnificently constructed highways. Unfortunately, when America was settled by the English, the settlers brought with them from the mother country the imperfect methods which had been inherited by them from the Dark Ages. The Britons, having but few wheeled vehicles, had neglected the highways constructed by the Romans, these roads ultimately falling into decay. Britain had for centuries been provided only with bridle-paths, which, except in dry weather, were almost impassable. The idea of a central control, which is the only method by which extensive work has ever been successfully accomplished, had died out, and Macadam and Telford had not revived highway construction at the time of America's early settlement.

To quote in part from a report of the Office of Road Inquiry, United States Department of Agriculture:

The first settlements in the United States were located along the seashore and upon the banks of navigable streams. Narrow Indian trails led from the coast settlements to the interior, and were the only lines of communication up to the seventeenth century. Indeed, for a century after the settlement at Plymouth Rock, there were but few roads in this country passable by wheeled vehicles. The little traffic carried on between settlements was maintained by boats and pack-trains. A systematic attempt at road-building was then impossible, owing to the crude state of society and the sparse population. Soon, an eagerness to penetrate the wilderness seized upon the pioneer. Acting upon it, he blazed his way through the forests, built temporary bridges, and, with the steady increase in wealth and population, the pack-trail was widened into a crude wagon-road, but without any attempt at its improvement. A century elapsed before anything like improved highways were thought of; in fact, it was not until the beginning of the present century that any real improvement was perceptible.

The first great American road of which history tells us was begun in 1711, and ran from New York to Philadelphia, being known as the "Old York Road." The opening of roads was an important affair at that period, and, doubtless, was more of an undertaking than is the construction of a railroad at the present day. By studying the history of the Old York Road, we see the potency of the adage that "the history of roads is the history of civilization." The Indian trail, the blazed trees, followed by the bridle-path, then the rough road for carts, subsequently graded and paved, are all stepping-stones to a higher degree of civilization and wealth.

In early Colonial days, roads were first built and maintained by the use of volunteer or free labor, and at the town meeting, held on the village green, the opening and maintenance of roads were the most

interesting subjects of discussion. The citizens would here offer their services free of charge to the community, for building and maintaining roads running through or by their lands. These offers, however, soon became so limited that the towns were forced to pass ordinances compelling all able-bodied men to work the road a specified number of days, or, in lieu of said labor, to pay a money tax to the pathmaster or road overseer.

It is easy to trace progress in all matters which were discussed on the village green, save one, that being the forced-labor system of working roads, which still exists in many of the States, and is yet found in some of the counties of California, where it is largely a farce—no greater one to-day, however, than it was in New England a century ago, as witness a letter under date of November 30, 1785, written by George Washington to Patrick Henry, then Governor of Virginia:

> Do you not think, my dear sir, that the credit, the saving, and the convenience of this country all require that our great roads leading from one place to another should be straightened, shortened, and established by law, and the power in the county courts to alter them be withdrawn? To me these things seem indispensably necessary, and it is my opinion that they will take place in time. The longer, therefore, that they are delayed, the more people will be injured by the alterations when they happen. It is equally clear to me that, putting the lowest valuation upon the labor of the people who work upon the roads under the existing law and the customs of the present day, the repairs of them by way of contract to be paid by an assessment in a certain district, until the period shall arrive when turnpikes may with propriety be established, would be infinitely less burthensome to the community than the present mode. In this case, the director would meet no favor. Every man in the district would give information of neglects, whereas *negligence under the present system is winked at by the only people who know the particulars or can inform against the overseers.* For strangers had rather encounter the inconvenience of bad roads than the trouble of an information, and go away prejudiced against the county for the polity of it.

This system of working out the tax and of lax highway methods was not too small a matter for the greatest of Americans to give thought to.

The maintaining of turnpike roads by chartered companies was inaugurated just prior to the outbreak of the Revolutionary War. State and National charters were given to these companies, which at first yielded large profits to their owners, and this system has been in vogue in Kentucky and some other States to a large extent to within recent years.

The Wilderness Turnpike was the name of one of the earliest, and ran from the Shenandoah Valley in Virginia, across the Allegheny Mountains at Cumberland Gap, thence to central Kentucky. This route, first opened for pack-trains, was afterwards so improved that it became the main road for wagon-trains from Virginia to the valley of the Ohio, a large commerce being carried on from Virginia to the west over it. During the first decade of this century, it was known as the oest highway south of the Potomac River; but, with the construction of railroads, its revenues became so limited that it was neglected and allowed to go to decay.

That these roads were of great importance may be illustrated in the case of the Philadelphia-Lancaster Pike, chartered in 1792 to build a road from Philadelphia to Lancaster, a distance of 60 miles. The charter having been secured, in ten days' time there were 2,275 subscribers for stock. As this was more than the law allowed, the names were all placed in a lottery wheel, and 600 drawn. With these, subscriptions were begun. The builders of that day, however, seemed to have known no more of road construction than do those of the present. The land having been condemned, the trees were felled and the roadbed prepared; the largest stones that could be found were dumped upon it for a foundation, and upon this colossal base earth and gravel were spread. Then the work was declared completed. But, when the washing rains came, deep holes appeared on every hand. Sharp stones extended above the surface, and the horses' limbs were badly cut and sometimes broken, as they sank between the bowlders. The gigantic error of the road-builder was then made plain. (This method, however, is still in vogue in some sections of California.) Indignation meetings were held, the Turnpike Company condemned, and the Legislature blamed for issuing the charter. Had it not been for an Englishman, who offered to rebuild the road on the Macadam plan, improved road construction would have received a severe blow. When the road was rebuilt by him, it was declared by all persons traveling it to be the best piece of highway in the United States.

The success of the Lancaster Pike encouraged road-building everywhere, and before the first decade of the new century had elapsed, many of the well-settled States were voting money, setting aside revenues derived from the sale of public lands, and establishing lotteries to build turnpikes. The prospect of increased land values by the construction of these improved roads, and of receiving large dividends from money invested in them, induced many to risk their all upon these schemes. Speculation ran riot. Turnpike-building was the rage; and in a few years a sum of money was invested almost as large as the public debt at the close of the Revolution. By the year 1811, over 317 pikes had been chartered and constructed in New York and the New England States; their length being slightly in excess of 4,500 miles, many miles being surfaced with thick wide planks, which, for a few years, were successful, but on their decay this method of surfacing was abandoned. The toll system also proved unsuccessful, and many of the companies lost money. Some were bought out by the States and counties, while others surrendered their charters, and gradually again the forced-labor system came into vogue. The States exercised no supervision whatever over the roads within their confines, and skilled road engineers and builders soon became a thing of the past.

Early in the present century, when the movement started in England by Telford and Macadam in favor of broken stone roads, the importance

of improved roads for military, postal, and commercial purposes began to be widely appreciated. Road reform assumed such proportions that it began to be one of the leading questions of national politics, being supported by such statesmen as Washington, Jefferson, Calhoun, and Clay. It was admittedly, next to the tariff, the most important subject under consideration in Congress—Congress being split into two parties on the subject. Those who believed in a liberal construction of the Constitution favored the construction of roads by the General Government, while the strict constructionists denied the power of the Government to spend money for such internal improvements.

During Jefferson's second term, Ohio was admitted, the act of admission containing a provision to the effect that five per cent of the net proceeds derived from the sale of public lands within the boundaries of the State should be expended in the construction of public roads, leading from the navigable waters emptying into the Atlantic Ocean to and through the State of Ohio. In 1806, the sum derived from this source amounted to over $600,000, and $30,000 was at once made available for the construction of the famous Cumberland Road. From its initial point, at Cumberland, Md., it was to extend through southwestern Pennsylvania, across the Allegheny Mountains, to the Ohio at Wheeling, W. Va., and thence to St. Louis, Mo. Constructed under the principles advanced by Telford and Macadam, it was so well built that it yet remains a good road, though it has long since passed out of the hands of the nation, and has not been repaired for years. The road was described by a writer, in 1879, as follows:

> It was excellently macadamized. The rivers and creeks were spanned by stone bridges, the distances indexed by iron mile-posts, and the toll-houses supplied with strong iron gates. Its projector and chief supporter was Henry Clay, whose services in its behalf are commemorated by a monument near Wheeling. There were often twenty gaily painted four-horse coaches traveling the road each way daily. The cattle and sheep were never out of sight. The canvas-covered wagons were drawn by from six to twelve horses. Within a mile of the road the country was a wilderness, but on the highway the traffic was as dense as in the main street of a town. Ten miles an hour is said to have been the usual speed for the coaches, but between Hagerstown and Frederick they were claimed to have made 26 miles in two hours. These coaches finally ceased running in 1853. There were also through freight wagons from Baltimore to Wheeling which carried ten tons; they were drawn by ten horses, and their rear wheels were ten feet high.

From 1810 to 1816, appropriations amounting to $680,000 were made by Congress for continuing the work on this road.

In 1817, John C. Calhoun, Henry Clay, and others favored the creation of a new fund for internal improvements. A bill was introduced in the House by Mr. Calhoun to set aside for roads and canals the bonus and dividends received by the United States from its newly chartered national banks. In supporting this measure, Mr. Calhoun, although a

staunch believer in the doctrine of State rights, delivered a speech before the House, in which he thus expressed himself:

Let it not be said that internal improvements may be wholly left to the enterprise of the States and of individuals. I know that much may be justly expected to be done by them; but in a country so new and so extensive as ours there is room enough for all. the General and State governments and individuals, to exert their resources. Many of the improvements contemplated are on too great a scale for the resources of the States or of individuals, and many of such a nature that the rival jealousy of the State, if left alone, might prevent. They require the resources and the general superintendence of the Government to effect and complete them.

But there are higher and more powerful considerations why Congress should take charge of this subject. If we were only to consider the pecuniary advantages of a good system of roads and canals, it might indeed admit of some doubt whether they ought not to be left wholly to individual exertions; but when we come to consider how intimately the strength and political prosperity of the Republic are connected with this subject, we find the most urgent reasons why we should apply our resources to them, Good roads and canals, judiciously laid out, are the proper remedy. Let us, then, bind the Republic together with a perfect system of roads and canals.

The fund proposed to be set apart in this bill is about $650,000 a year, which is doubtless too small to effect such great objects of itself, but it will be a good beginning. Every portion of the community—the farmer, the mechanic, and the merchant—will feel its good effects; and, what is of greatest importance, the strength of the community will be greatly augmented and its political prosperity rendered more secure.

Henry Clay also spoke in favor of the proposed Act with reference to its constitutional merits. The bill was unfortunately amended, however, and President Monroe vetoed it. An attempt was made to pass it over the President's head, but failed of the necessary two-thirds majority. Upon the defeat of the bill, Congress returned to its former method of providing funds derived from the sale of public lands.

In 1811, five per cent of the net proceeds of the sale of public lands in Louisiana was given to that State for the building of roads; in 1816, the same percentage was given to Indiana; in 1817, a like sum to Mississippi; in 1818, two per cent was given to Illinois; in 1819, five per cent to Alabama; in 1820, five per cent to Missouri; in 1845, five per cent to Iowa; the sum total derived in this way exceeding $7,000,000.

After the construction of the Cumberland Road was begun, twelve other great national highways were laid out, and appropriations given them amounting to a total of $1,600,000. Supplementing these appropriations, grants of land were made from time to time by the States to aid in the work, and the labor of United States troops was occasionally employed. The financial crisis of 1837 put a quietus on all projects requiring large Government expenditures.

In 1854, another period of activity began, and lasted until the outbreak of the Civil War, during which time appropriations aggregating $1,600,000 were again made.

From that time to this, only a few military roads have been built, and, of late years, nothing has been done in the way of National aid, save the building of roads in the District of Columbia and in National cemeteries and reservations. It would seem, however, at the present

time that Congress would again become actively awake to the importance of the improvement. Some road-reformers think, as thought many of the forefathers who founded the Republic, that the General Government should aid in the building of the principal roads. This idea has, however, met with little encouragement.

Out of the agitation, however, has grown the Office of Public Road Inquiry, attached to the Department of Agriculture. This bureau was created in 1893, to collect and disseminate information on the road subject, to conduct investigations, inquiries, and experiments regarding road materials and road construction, and to encourage, by object-lessons and otherwise, the building of better roads. Numerous bulletins and circulars have been issued by it, which have proved of much use to practical road-builders, and a number of experimental roads have been constructed in various sections of the United States. There is now before the National Government a project for the construction of great National highways, one of them commencing in Maine and running to San Diego, California. This is in the hands of a Special National Highway Commission, embodying among its members such well-known men as Lieutenant-General Nelson A. Miles and Brigadier-General Roy Stone; while, within California, the National Government has conducted an examination for roads within the Yosemite National Park, and bills are now pending in Congress for the acquirement of certain existing toll-roads, and for the construction of new roads within the Park, amounting in the aggregate to $400,000.

HIGHWAY LEGISLATION IN OTHER STATES.

Many of the States of the Union have passed new and progressive road laws, the general trend of this legislation being as follows:

(1) The establishment of State Highway Commissions;

(2) The construction of State roads, and extension of State aid to road-building;

(3) Construction by townships, counties, and districts, with power to issue bonds;

(4) More liberal tax levies;

(5) Local assessments, according to benefits;

(6) The substitution of a money tax instead of labor;

(7) Wide-tire laws;

(8) Provisions for convict labor.

The following is a brief résumé of

THE ADMINISTRATION OF ROADS IN OTHER STATES.*

ALABAMA.

The Court of County Commissioners selects appraisers for each precinct, these in turn appointing overseers, who have general charge of road-repairing in their particular sections. Every able-bodied man is liable to ten days' labor on roads, special acts in some of the counties allowing this to be commuted in money. Some counties have a special road-tax out of the general levy, while others issue bonds, to be redeemed out of the general tax receipts. Every Legislature passes special acts for the various counties, these acts varying much in their provisions.

While a considerable mileage of good macadam roads has been constructed, these are confined to the counties issuing bonds, or requiring the road-taxes to be paid in money.

ARKANSAS.

Road overseers are appointed by the County Judge. Every man is required to work from five to ten days a year on the roads, and but little improvement has resulted. The roads are very poor.

COLORADO.

The County Commissioners divide the counties into road districts, appointing a road overseer for each, who sees to general repairs, etc., of the road. The Commissioners also levy a property road-tax, one half of which must be spent in the district in which it is levied, the balance at the discretion of the Commissioners. Every able-bodied man between the ages of 21 and 45 years is subject to a road-tax of $2, which can be worked out by two days' labor on the roads, or one day's work with team, or is liable to a penalty of $5.

CONNECTICUT.

This State has made rapid progress in the good roads movement, and, since the State-aid system was adopted five years ago, some 500 miles of excellent Telford, macadam, and gravel roads have been constructed, while the improvement of several hundred miles is in progress or has been projected.

Primarily, the roads are under the supervision of the Selectmen of the town, who employ laborers and supervise the work of road improvement, the necessary money being derived from the general tax fund. The old practice of working out taxes is fast disappearing.

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*Information on this subject has been obtained from correspondence with various officials of other States, from various pamphlets and bulletins of Office of Road Inquiry, Department of Agriculture, from Report on Highways of Maryland, Maryland Geological Survey, 1899, and from other sources.

In 1895 a law was passed whereby three Highway Commissioners were appointed by the Governor of the State, with an appropriation of $75,000 annually, to be spent on the roads of the State. Under the Act every town voting to improve its roads had a survey made, specifications drawn up, and submitted to the State Highway Commission. If approved, a contract was let, the work being carried on under the superintendence of the Selectmen, and the expenses met—one third by the town, one third by the county, and one third by the State. In 1897 the number of Highway Commissioners was reduced to one, the appropriation being increased to $100,000 annually, and the expense of road construction was divided equally between the town and the State.

The large mileage of improved roads (noted above) under this system has proved the popularity and efficacy of the present law, and the people of the various towns, encouraged by the State aid, and recognizing the great advantages and conveniences of good roads, have readily voted sums for their improvement.

DELAWARE.

In this State two road systems exist. In New Castle County, Road Commissioners are elected, they having general charge of the roads and bridges, with power to appoint overseers; they also levy the tax, which may be worked out. In Kent and Sussex counties powers similar to those of the Road Commissioners lie with the Levy Court, which appoints supervisors, fixes the amount of road-tax, etc.

FLORIDA.

Roads are in charge of the county officials, the tax being paid largely in money, some of it being worked out. Natural conditions are such as to make most of the roads fairly good, and considerable interest is manifested in their further improvement.

GEORGIA.

In this State road improvement is making a steady march. Roads are being substantially improved, many miles being macadamized or graveled.

The country is divided into road districts, each having three Commissioners, with power to further divide the districts into sections and appoint overseers.

Every able-bodied man is subject to fifteen days' work annually on the roads. Counties are permitted to levy a road fund, to organize road forces, or to contract for repairs.

Much of the work of macadamizing and graveling has been performed by convict labor, which has proved successful in this State.

There are two classes of roads: the first class must be 30 feet wide, and the second class not less than 20 feet in width.

IDAHO.

The roads are in charge of County Commissioners, who appoint Road Supervisors to see to repairs.

The road-tax, consisting of property- and poll-tax, is levied in the county, and spent in the district where it is raised. It may be worked out. Some help is received from the State in regions where the expense of road- or bridge-building is too great to be borne by the locality.

ILLINOIS.

The township and county systems of road government are both in general use. There are three Commissioners in the township or county, who have complete charge of the roads and bridges in their respective township or county. They may contract, employ laborers, or appoint a general superintendent and overseers, and report semi-annually on road matters and finances to the Board of Town Auditors. They levy a road-tax, consisting of property- and poll-tax, the latter being commutable by labor. Upon petition, roads may be altered, opened, or vacated by the Commissioners of Highways, provisions being made for arbitration before a jury, or appeal to three County Supervisors, if necessary.

The County Board may render financial assistance to a township in case of expenditures too great to be borne by the township, such as the building of expensive bridges, etc.

The townships or counties may vote a special tax for road improvement, and some good results have been accomplished in the way of the macadamizing and graveling of highways. The matters of wide-tires and sign-boards have also received some attention.

INDIANA.

The counties are divided into townships, each having a Trustee, and the townships are subdivided into road districts, over each of which a Supervisor is elected, who is under the direction of the Township Trustees. The latter, with the concurrence of the County Commissioners, fixes the road-tax, part of which must be worked out or a fine paid. An additional levy may be made if the ordinary levy does not produce sufficient funds.

Upon petition for a new road, the Commissioners appoint viewers, who decide on the location and amount of damages. The County Commissioners report their decision to the Trustees of the township through which the road passes, and the latter order the Supervisors to do the work. County roads shall not be less than 30 feet wide, and township roads 25 feet wide.

The State of Indiana has a large mileage of graded, graveled, and piked highways, most of which have been acquired by construction and

purchase by the County Commissioners, on petition or vote, and paid for by special tax or county bond.

IOWA.

Each county is divided into townships, and the Township Trustees have special charge of the roads in their respective townships. The County Boards of Supervisors have general supervision over the roads of the counties, and may also levy a road fund, to be expended under their direction on roads in the county, by contract or otherwise.

The Trustees may subdivide their districts, levy road-tax, and decide as to the amount to be paid in cash and amount in labor; they may also appoint a Township Superintendent of Roads, and, in case of subdivision of the township into districts, part of the road fund is laid aside for general purposes, such as the purchase of tools, road machinery, sign-posts, etc., and the balance expended in the district where it is raised.

The opening, altering, or vacating of a road is accomplished by petition to the Board of County Supervisors. The County Auditor appoints a commissioner to report on the matter, and, if there be no objection, work is proceeded with. In case of a claim for damages, the Auditor appoints three appraisers, and the County Supervisors decide from their report as to the amount of damages, and whether or not the work shall proceed. Appeal for damages may be had to the County District Court.

All able-bodied men are subject to two days' work on the roads, or to a fine of $3 for each day they fail to work.

The general width of roads is 66 feet, but the Supervisors may limit this to 40 feet.

The County Auditor is required to keep a plat of all public roads in each township of his county, on a scale of not less than 4 inches to the mile.

KANSAS.

Very little attempt has been made toward the betterment of roads in this State. The roads are in charge of Township Overseers, who are elected by the popular vote.

Road-tax, consisting of property- and poll-tax, is levied by the county officials, and may be partly worked out.

KENTUCKY.

Kentucky was famous for her fine roads a generation ago, and few States have been more liberal in promoting the building of better highways.

Over 1,000 miles of excellent stone roads have been built in Kentucky, as toll, county, or State roads. The old toll-roads are being bought up and made free by the various counties as fast as possible, prices ranging from $75 to $250 per mile. Some of these, however, are given up to the

counties at no cost whatever. Shelby County has recently bought up 117 miles of turnpike at a total cost of about $15,000. A large percentage of the roads, however, is still worked by forced labor, every man between 18 and 50 years of age, not a citizen of an incorporated city or town, being compelled to work on the road six days a year, or pay a fine of $2.50 per day.

The Fiscal Court of each county has general charge of roads and bridges, and levies the annual road- and poll-tax, the County Judge dividing the county into precincts and appointing an overseer for each. In some of the counties, the court appoints a supervisor (as a rule, an engineer) to take general charge of roads and bridges, and he may make contracts for their repair.

Some counties have borrowed money on bonds.

All male persons in county jails or workhouses, under sentence of hard labor, shall be available for public work on the roads.

A movement is now on foot to secure more uniform taxation by passing a State-aid law, and the agitation has already led to a general crusade which foreshadows thorough reformation.

LOUISIANA.

There has been some slight road agitation in this State, but with little result. The Parish Police Jury appoints road overseers, road expenses being met from the general parish tax-fund, some of the parishes keeping roads in repair by contract.

Every able-bodied citizen is compelled to labor twelve days annually on the roads.

MAINE.

Road Commissioners, who are elected annually by the town, have control of the roads in their respective townships, except in the thinly populated districts, or "plantations," where the County Commissioners have charge. In some of the smaller towns, a special road-tax is levied, but, as a rule, the road expenses are met from the general tax-fund of the town.

The State lends some little aid by an occasional appropriation for a special road or bridge, this being constructed under supervision of a special agent appointed by the land-agent.

MARYLAND.

The Maryland Highway Division of the State Geological Survey, since its creation by the Legislature in 1898, has made a searching and most careful inquiry into the road question in that State, embodying the result of such investigation in a most exhaustive and interesting report, strongly recommending the creation of a State Highway Commission.

As a rule, the roads of the various counties are under the immediate charge of Supervisors, who employ laborers, make contracts, etc., for construction and maintenance of roads.

From the report of the Geological Survey, it appears that good road material is abundant in most sections of the State.

There are about 500 miles of toll-road in the State, including among their number some of the oldest pikes in the United States. The total mileage of roads is given as 14,483, of which there are 890 miles of stone roads, 225 miles of graveled roads, 250 miles of shell roads, and 13,118 miles of dirt roads; or, classifying the roads as main thoroughfares and byroads, there are found to be 2,021 miles of main roads, or about 14 per cent of the total mileage.

In view of the excellent recommendations in the report and the able manner in which the subject has been handled by the Geological Survey, road-building in Maryland will undoubtedly receive a great impetus, and reform in the way of more uniform road laws, with a central authority, will likely result.

MASSACHUSETTS.

This State has been one of the leaders in the agitation for road improvement. A permanent Highway Commission, consisting of three Commissioners, was created by the Legislature of 1893. Most liberal appropriations have been granted the Commission for the building and maintaining of State roads—in 1894, $300,000; in 1895, $400,000; running as high as $800,000 in 1897; $400,000 in 1898, and $500,000 in 1899.

The Selectmen of a town, the Mayor and Aldermen of a city, or the County Commissioners may petition the Highway Commission to have a road improved and maintained by the State, and, if the plans are satisfactory, the Commission undertakes the work. Not more than 10 miles of road can be built by the Commission in any one county in one year. The whole expense is primarily borne by the Commission, but the county in which the improvements are made must repay to the State one fourth of the amount expended within six years after the construction of a State road.

In order to meet the high expense of the Commission, a highway loan has been made, amounting to $2,700,000, and 3½ per cent thirty-year bonds issued to raise the money.

About 300 miles of excellent road have been built by the Commission, a great part of this mileage being over the worst and most difficult parts of the country to traverse; and such an object-lesson of convenience and economy have these improved highways proven to the people that petitions are being continually received by the State Highway Commission for the improvement of roads, to an amount far in excess even of

the liberal appropriations by the State. The average expenditure has been about $9,000 per mile, but, as noted above, attention has been first given to the worst parts of the highway system.

To the State of Massachusetts and her Highway Commission are due the thanks and praise of all interested in road reform, for solving, as they seem to have done, the great question of the proper and lasting (and therefore, the most economical) method of road construction and maintenance.

MICHIGAN.

The district and township system was formerly entirely in use in this State; but in 1893 a law was passed allowing counties, on vote of the people, to revert to the county government method. Under this system of administration all the county roads are under the direction of the County Road Commissioners, and the office of Township Commissioner ceases to exist.

By an Act of the Legislature of 1895, in any county where the Supervisors refuse to submit the question of adopting the county road system, or where the question has failed to carry, the question of township roads may be submitted.

Under the township system the amount of road-tax in each township is fixed annually by the vote of the people, who also decide as to what proportion shall be paid in cash and what proportion shall be worked out. There is also a poll-tax.

When construction or repair work is necessary to be done on a road, if the amount exceeds $50 it must be let by contract; if in excess of $100, the Road Commissioners must have the concurrence of the Township Board, the latter exercising authority over the expenditure of sums up to $1,000, and work, the cost of which will exceed this amount, can only be undertaken on vote of the people. The Road Commissioners have the right to alter, vacate, or open roads, power of decision on appeal vesting in the Township Board.

MINNESOTA.

The State of Minnesota is rapidly falling into line with the good roads movement, and, undoubtedly, ere long will establish a State Commission.

In 1897 an amendment to the Constitution, permitting the State to aid in highway construction, was adopted by a vote of the people, and in 1899 a bill was introduced to create a State Highway Commission for the purpose of investigating the road problem in the State, and to establish a highway fund whereby the State might pay one third of the expense of construction and maintenance of the most important highways in the State. Owing, however, to the fact that the constitutional amendment above mentioned was not clearly understood, the bill failed

of passage. But the movement is by no means dead, and, when a proper understanding is reached, a State law along the lines mentioned will be enacted.

At present the roads are generally under the supervision of overseers, who are elected by the township voters. A property- and poll-tax are collected, which may be worked out. Under the statutes of 1895, upon a petition being filed with the Auditor, the Board of Commissioners may construct the road. Viewers and engineers shall be appointed to assess damages, estimate costs, etc. Bonds may be issued as the work progresses, and a tax levied to meet the interest on such bonds, and to make a sinking fund. The election of overseers and the collection of poll-tax may be abolished on vote of the people in any township, and the roads put under the direct supervision of the Township Supervisors.

MISSISSIPPI.

Little interest is manifested in the improvement of roads. The County Supervisors appoint overseers, who have charge of road repairs. Every able-bodied male citizen is subject to ten days' work on the roads, but this law is not rigidly enforced.

MISSOURI.

The counties are divided into districts, over each of which the County Court appoints three Commissioners, who have entire control of all road and bridge work, with power to employ laborers or to make contracts for the necessary work.

There is a property- and poll-tax, the latter commutable by labor, both expendable in the district where collected. In addition to these taxes, there is collected a special tax of 15 cents on the $100 assessed valuation of real and personal property, to be spent on the county roads.

The use of a portion of the liquor license for road work has become general in counties throughout the State.

Over $3,000,000 is expended annually on roads.

MONTANA.

The counties are divided by the County Commissioners into road districts, and a supervisor is annually elected for each district, to serve one year. The supervisors, under the Commissioners, have charge of the roads, employing labor therefor. A property-tax of from one to two mills on the dollar, and a poll-tax of $3 on voters, are levied by the Commissioners, which taxes may be worked out.

NEBRASKA.

Natural conditions tend toward the easy construction and maintenance of roads.

A labor and money tax are levied, part of the latter being commutable in work.

Townships and counties are divided into road districts, with overseers in charge of the same.

NEVADA.

The roads are controlled by the County Commissioners, who, upon the application of a majority of the voters of any county, may open, alter, locate, or vacate any public road.

NEW HAMPSHIRE.

Under an act of the Legislature of 1899, the following law became effective in those towns which, by vote, adopted it:

Each town is divided into as many road districts as the Selectmen of the town may think expedient, they appointing a Surveyor of Highways to take charge of the roads in each district. As a rule, the taxes are expended in the district in which they are collected, but, if there be a surplus in any district, the Selectmen have the right to transfer such surplus to the road fund of any other district. About one fourth of the counties have voted to adopt this law.

In general, each town constitutes a road district, the town electing from one to three Highway Agents to supervise all work on roads and bridges. At the annual election of the town, the road-taxes are fixed as a certain proportion of the polls and of the general taxes levied.

Some aid has been received from the State in the construction of roads, and the State Board of Agriculture now has in hand the matter of disseminating information as to road construction and maintenance.

NEW JERSEY.*

New Jersey was the first State to take any radical step toward the improvement of her public highways. Her State-aid law was passed in 1891. It provides that on petition of the owners of two thirds of the lands bordering any public road, not less than a mile in length, asking that the road be improved, and agreeing to pay 10 per cent of the cost, the county officials shall improve the road, one third of the expenses to be borne by the State, if the road is brought to the standard fixed by the State Commissioner of Public Roads, and the balance ($66\frac{2}{3}$ per cent) by the county. The State's expenditures for such improvements in any one year are limited to $150,000, while the county is limited to one fourth of one per cent of its assessed valuation. At this rate, the law makes possible the expenditure of $450,000 a year, and at $3,000 per mile this builds 150 miles of road. Ten miles of road were built in 1892, 25 miles in 1893, 60 miles in 1894, and since 1895 the application for new roads has been far in excess of the limit prescribed by law.

Under this law, about 450 miles of improved road have already been built in New Jersey, the State's portion of the expense being about

*Yearbook, U. S. Dept. Agriculture, 1899.

$715,800. The counties and towns have built out of their own treasuries 450 more miles, which brings the total mileage of improved roads in the State up to 900. These roads cost at first about $6,000 per mile, but on account of the reduction in the price of materials and the increase of labor-saving machinery the cost has been reduced to about one half of this amount. The farmers, who at first strongly opposed the law, are now equally enthusiastic for it, and more roads are being petitioned for than can possibly be built in many years out of the limited State appropriation. The system seems to be popular with all classes.

NEW YORK.

The Legislature of 1898 passed a bill providing for the improvement of roads by State aid. The County Supervisors may, of their own motion or on petition of the property-holders, request the State Engineer to improve certain county roads. Surveys are made, and maps and specifications prepared, and, on approval by the State Engineer, the County Engineer (if there be one) assumes charge of the work. If there be no County Engineer, a competent engineer is appointed by the State Engineer to supervise the work. The State stands 50 per cent of the cost of such improvement, the county's share is 35 per cent, and the town's share the remainder.

The law seems to give satisfaction; a number of miles of excellent road have been constructed, and work is in progress under its provisions.

Under an Act of 1895, bonds may be issued to defray the expenses of purchasing road material in certain towns adjoining cities of 35,000 inhabitants.

NORTH CAROLINA.

In general, the counties are divided into townships, and these are subdivided into road districts. In some counties, a Road Superintendent is elected by the people or by the County Commissioners, and he in turn appoints supervisors of the various townships. Where no superintendent is elected, the supervisors are elected by County Commissioners.

Many of the counties levy a property- and poll-tax, and some have, by virtue of State legislation, issued bonds for road improvement.

According to legislation in 1899, modeled after the former "Mecklenburg law" of 1879, and applying to a number of counties, the County Superintendent of Roads, or Township Supervisors, are elected by the County Commissioners.

In some counties, a regular road-tax is levied, and each able-bodied man must labor four days on the road or pay $2 poll-tax, but this system of forced labor is dying out.

Laws are in force, providing for the use of convict labor in improving highways, and North Carolina has made greater progress and built more miles of road under this system than any other State.

NORTH DAKOTA.

Under the law of 1895, the several town boards have general supervision over the roads, highways, and bridges throughout their several townships.

The amount of road-tax, not to exceed 80 cents on $100 of assessed value of real and personal property, is fixed by vote at the regular annual town meeting, and, on petition, the question of maintenance of roads by contract may be submitted to the voters of the township.

In addition to this, counties of more than 3,000 inhabitants may levy a county road-fund, to be expended under the direction of the County Commissioners.

OHIO.

The roads are classified as: (1) State roads, connecting the counties; (2) County roads; and (3) Township roads. The County Commissioners have charge of the State and County roads, and fix the amount of tax for the same, while the Township Trustees exercise similar authority over the township roads.

Laws are in effect, providing for the proper marking of the State and County roads by monuments, for proper engineering supervision, etc.

OREGON.

The County Court has general supervision over all roads, and may open, alter, or vacate them on petition, after the report of three viewers, who are appointed by the court.

The road-tax is levied in labor, consisting of a property-tax of one day's labor for each $1,000 of assessed valuation, and poll-tax of two days' work annually. These may be commuted in money by order of the County Court.

The general tax-fund may be drawn on in some instances of unusual expense, such as bridge construction, etc.

A fund for the improvement of roads and bridges has been created out of a portion of the receipts from the sale of the public lands of the State and from the tax collected by the National Government in 1861, which has since been repaid to the State. This will be divided proportionately among the counties.

The employment of convicts on county roads, under the Supervisors, is authorized, and the placing of guide-posts and milestones is provided for by law.

In 1900, a wide-tire law became effective, providing for a rebate of $1 per wheel on all wagons having tires over three inches wide, and of $2 per wagon having tires over four inches wide.

The roads in the State are generally good. In one county alone (Allegheny) 25 miles of road were opened, improved, and dedicated to the public in 1898, and in 1899 this was increased to 50 miles. These

roads have been macadamized and drained at an average cost of about $6,000 per mile. The width of the main roads is about 33 feet, and they traverse populous rural districts. About 85 miles of road in this county are either contracted for or are now undergoing improvement.

RHODE ISLAND.

The roads are under the supervision of the town Highway Commissioners, who appoint supervisors. At the annual town meeting, a certain sum for the construction and maintenance of roads is appropriated from the general tax-fund.

At the suggestion of the State Commissioner of Highways, the Legislature recently passed a law, enabling him to build a half-mile sample of good macadamized highway in each town applying for the same, three fourths of the cost being met by the State and one fourth by the town. Although this law has been repealed, these permanent object-lessons have been of great benefit to the towns, and are conducive to more liberal appropriations for roads, as well as to more thorough construction. Out of 2,240 miles of highway in Rhode Island, about 500 miles have been improved by the use of gravel and stone.

A wide-tire law has been passed, to go into effect in the year 1902.

SOUTH CAROLINA.

The Township Supervisors appoint road overseers, who supervise the work on the roads.

The people of Columbia, S. C., have recently expended $6,000 in the purchase of a fine plant of machinery for road-building, consisting of steam-rollers, rock-crusher, road-grading machines, etc. The rock-crusher is capable of turning out 60 tons of rock daily. Good results will be accomplished, as this is a step in the right direction, and the people of other sections will soon realize the necessity of good roads, constructed in an economical manner by the use of improved machinery.

Convict labor has been employed to some extent.

SOUTH DAKOTA.

In the level portions of the State the roads are generally good, but in the mountainous parts they are, as a rule, exceedingly bad, and but little effort seems to have been made toward their improvement.

The counties are generally divided into townships, the trustees of which have charge of the roads, Road Supervisors being elected under them. Where the township system does not exist, the County Commissioners have charge. The County Commissioners fix the road-tax, consisting of a property- and poll-tax, both commutable by labor, to be expended or worked out in the district where the tax is levied.

TENNESSEE.

A long step was taken in Tennessee by the adoption of a new road law, which went into effect January 1, 1900. This law abolished the office of Road District Overseer, and under it but one Road Commissioner for each county is elected biennially by the County Court, he to have complete charge and oversight of all road and bridge work in his county, the opening, closing, and altering of roads being accomplished on petition to the Commissioner, the Court fixing damages, etc. All work on the roads must be done by contract, proposals for the same being submitted at the beginning of each calendar year, and the contractors have the right to call on delinquent taxpayers for labor. A high standard of specifications has been established for the main highways.

Bradley County, Tenn., has now about 100 miles of gravel and stone roads, having issued bonds for their construction, and there is a general revival of road-building throughout the entire State.

Convict labor has been employed successfully.

A property-tax is levied by the County Court, and every able-bodied man is compelled to render a certain amount of work.

There is a large mileage of toll-roads throughout the State.

TEXAS.

The roads, as a rule, are in poor condition.

Supervisors, appointed by the County Court, have general charge of the roads.

A poll-tax is levied, requiring five days' work on the roads.

Convict labor has been employed to some extent.

UTAH.

The County Court exercises supervision over all road work, having power to open, alter, or close roads. The counties are divided into districts by the Court, which appoints a Supervisor biennially for each district.

A poll-tax is collected, which may be rendered in money or labor.

VERMONT.

Vermont has recently adopted the State system, and with much success, and an outlook for a bright future. The State Commissioner states that in the year 1899, 117 miles of road were built, being a mileage in excess of the total for the years 1892 to 1898, inclusive. At this rate, the Commissioner states, a fine State highway system will be established in a few years. The State pays one half of the cost of the improvement of main thoroughfares, while the other half is paid by the towns through which the road passes.

The duties of the State Commissioner are largely advisory, he conferring with the Road Commissioners of the town. The latter are elected annually for each town.

A road-tax is levied annually by the Selectmen of the town, and the money expended therein; the general tax-fund being drawn upon for special work, such as bridge construction and repairs, etc.

VIRGINIA.

The general conditions in Kentucky are applicable also to the State of Virginia, where the State-aid sentiment is also becoming very strong, and movement is now on foot for a more general system of road administration.

The county and townships systems are in vogue. A property road-tax and, in some counties, a poll-tax are levied by the township or county officers.

WASHINGTON.

The County Commissioners have primary jurisdiction, having power to appoint viewers for the purpose of opening new roads.

The counties are divided into districts, a Supervisor being elected annually for each, and the amount of road-tax fixed by vote, commutable by labor. A road-tax, payable in money, is also levied.

WEST VIRGINIA.

The County Court has general supervision over the roads. It appoints viewers to report upon the advisability of opening new roads, to assess damages, etc. It determines the amount of road-tax, part of which may be worked out, and appoints a surveyor for each district, who has direct charge over roads and bridges, with authority to employ labor.

Expensive work, such as building of bridges, etc., is done by contract, and is paid for out of the general tax-fund, by special levy, or by the issue of bonds.

There is a movement on foot looking toward the establishment of a better system of laws.

WISCONSIN.

Interest in road improvement in this State has recently been aroused by the Geological and Natural History Survey of the State, which has assumed the task of studying the road problem.

The Town Supervisors have complete control of the roads, levying a property- and poll-tax.

The wide-tire movement is encouraged by the exemption from taxation of wagons with tires three inches wide, or over.

WYOMING.

The County Commissioners have control of road affairs, and have power to open, alter, or close roads on report of viewers (or appraisers,

if necessary) appointed by them, appeal being had to the Circuit Court; they also fix the annual road-tax levy.

A County Supervisor, elected biennially, has charge of the care of the roads, or, in case the county is divided into road districts, a Supervisor is elected for each.

ROAD ADMINISTRATION IN FOREIGN COUNTRIES.

In 1891, the Bureau of Statistics, Department of State of the United States, compiled and published reports from the Consuls of the United States on streets and highways in their several districts, the same being reissued, with supplementary reports, from the Bureau of Foreign Commerce, Department of State, in 1897, under the title of "Streets and Highways in Foreign Countries."

A short summary of the more important of these reports from the European consulates may not be amiss:

AUSTRIA.

The roads are classified as: (1) Imperial or State roads, which are subject to the administration and legislation of the State; and (2) Public roads, which are subject to provincial legislation.

In 1873, the total length of State roads was 15,003 kilometres, or about 9,300 miles. Only a small proportion of these roads is built with a heavy stone foundation, most of them being constructed of ballast or broken stone.

For the immediate carrying out of the work necessary for keeping in repair the State roads, road-keepers are employed by the Government; and road-masters and inspectors are employed in the larger districts, for conducting and superintending the work on the roads.

The width of tires is regulated by law.

In Austria, the average receipts of toll, collected upon the State roads, in the years 1860–1873, was 2,618,549 florins per annum, or over $900,000.

The Public roads are subdivided into: (1) Provincial roads, which have been so declared from their importance as such by resolution of the Diet; (2) District roads, which have been appointed as such by the respective district authorities; and (3) Community roads, embracing all other roads. Rules are prescribed for the uniform measurement of roads, as to width, depth of foundation, ditching, gradient, planting of trees, etc.

The building and maintenance of Provincial roads are incumbent upon the Provincial Committee, and the District roads are under the care of the District Road Board, which is supervised in its work by the Provincial Committee. Costs for the building and maintenance of Provincial roads are paid from the Provincial fund, while the District roads are maintained by the respective districts.

BELGIUM.

The thoroughfares in the kingdom of Belgium are: (1) Government roads, running from one part of the kingdom to another, controlled and managed by the State authorities; (2) Provincial roads, or chaussées, running between two points in a province, constructed and controlled by the provincial authorities; and (3) Communal roads, controlled by the communal authorities. They are paved in the center, a dirt road on each side, and are bordered with trees.

Each of the nine provinces has a Bureau of Roads and Bridges, whose chief gives his undivided attention to these matters.

The roads are most carefully engineered in the first place, heavy grades being carefully avoided. They are carefully paved and surfaced, and well rolled when repairs are made, most rigid specifications being adhered to in contract work.

Such a perfection has road-building attained in Belgium that the highways enter into successful competition with the railroads, and one is struck with astonishment at the enormous loads drawn by horses and dogs in this country.

FRANCE.

The French roads have compelled the respect and admiration of foreigners for a century, and they stand to-day as substantial monuments to the Napoleonic foresight and shrewdness, the modern road-system of the country having been inaugurated by the First Napoleon, and carried forward to its satisfactory and splendid conclusion by Napoleon the Third.

Of this country it is said that the far-reaching and splendidly maintained road-system has distinctly favored the success of the small landed proprietors, and in their prosperity, and the ensuing distribution of wealth, lies the key to the secret of the wonderful financial vitality and solid prosperity of the French nation. The road and bridge service of France is a strong and effective organization. Responsible men are employed in it, thoroughly trained, and their work is subjected to close inspection by the Government engineers.

The routes are divided into sections of from half a mile to three miles in length, each of which is confided to a man or a number of men, so that every foot of roadway is inspected daily, and kept in thorough repair. The highways of France are remarkable for their durability, evenness, and cleanliness. They are swept and watered every day, and kept in scrupulous order. Neither dirt, decay, nor rubbish is about, to suggest neglect or ill care.

The ways of communication are divided, generally, into three classes: (1) National or State roads, constructed and maintained by the State; (2) Department roads, in charge of the departments; and (3) Township roads, which, though constructed by the communes, receive in most

cases support either from the State or from the departments for their maintenance. Each taxpayer is obliged to work three days a year for the maintenance of the country roads, or pay an amount of money equivalent to the compensation of a laborer for three days.

The National roads, radiating from Paris, are placed under the jurisdiction of the Department of Bridges and Roads (Ponts et Chaussées), which is attached to the Bureau of the Minister of Public Works, who is a member of the Government cabinet, and the roads are maintained out of the General State Fund. All road work is carried on under the supervision of skilled engineers, who, previous to the commencement of work, make a careful examination and survey of the route, and draw up rigid specifications for the contractors. Provisions are made by law for the condemnation of lands for road purposes.

The bridge system is very thorough, most of the bridges being built of stone, though, in recent years, the use of iron and steel structures has been introduced.

The average cost of building a road is about $6,600 per kilometre (1,093 yards), or somewhat over $10,000 per mile, being $4,000 per kilometre in the valleys, and $9,000 in the mountainous regions.

GERMANY.

The excellent roads of Germany are mainly a heritage from the century which immediately preceded the introduction of railroads, and the construction and maintenance of highways was then an important function of the National Government administered by a vast bureau or department, similar to the Department of Bridges and Roads now maintained in France.

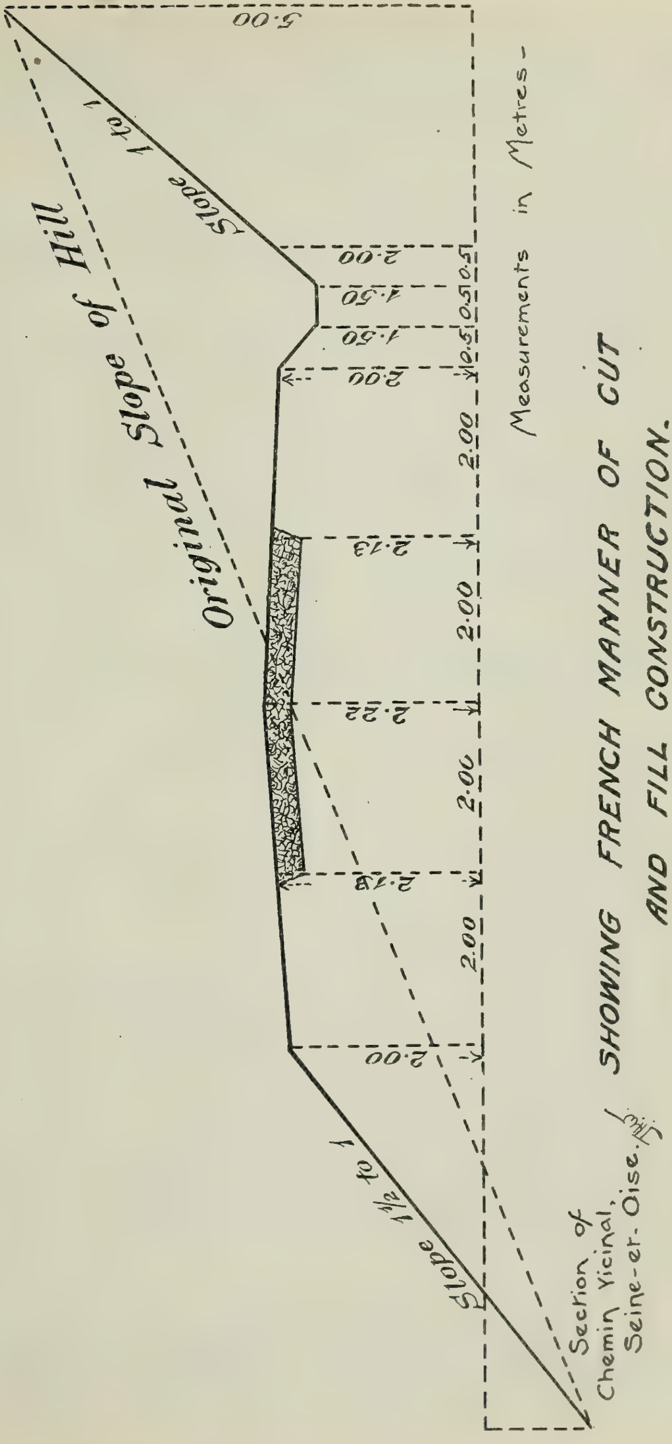
On the organization of the Empire in 1870, the State assumed control of the principal railways, and turned the public roads over to the care of the provinces; consequently, each of the provinces has its separate system of road administration for road construction and maintenance.

In respect to construction, the German process is identical with that of France, skilled engineers having supervision over all work of this nature. The general construction is of Telford, the foundation consisting of stones about 8 inches in height, with a top dressing of basalt, limestone, or other road metal.

Conditions prevailing in Saxony are generally applicable to the other subdivisions of the German Empire, and are about as follows:

The general classification obtaining at present is: (1) State roads; (2) Country roads, connecting two or more towns; and (3) Private ways.

The tolls, which were formerly collected on the State roads and bridges, have been abolished since 1884. Their general supervision and management of construction are intrusted to a State Road Commissioner, the technical direction of the works being in charge of a road director.



SHOWING FRENCH MANNER OF CUT AND FILL CONSTRUCTION.

FIG. 1.

Local supervision in the districts is exercised by the "Amtshauptmannschaft," which is the chief executive and ministerial office of the district. The direct technical control, making of plans, engineering supervision, etc., are in the hands of the Inspectors of Roads and Navigable Ways, who must be skilled engineers, and who may make contracts for repairs not exceeding $130. For the execution of larger works the inspector must receive the consent of the Amtshauptmannschaft. A number of State roadmasters are employed, who are charged with the immediate direction of the work of keeping both the State and country roads of their district in repair.

The "connecting," or country, roads are maintained by the parishes through which they pass. The district board is charged with their supervision. Every parish is left free to determine the manner of raising means for defraying that part of the expense of road construction and repair which is not provided for by the State or district. Some parishes have been authorized to levy tolls for this purpose.

The private ways, built by land-owners on their own land, are not subject to ministerial regulations.

In the Kingdom of Saxony the cultivation of trees along the roads has received great attention, and it is stated that in the year 1890 a sum equivalent to over $30,000 was realized from the sale of fruit grown along the State roads in this kingdom.

Square-cut stones, painted white, show distances in kilometres, the figures being cut deeply in the stone.

ITALY.

In Italy the Minister of Public Works has general supervision over the roads, which are classified as:

(1) National roads, which connect the chief cities, and are built and maintained by the Government.

(2) Provincial roads, connecting the capitals of different provinces with the seats of the several districts into which the provinces are divided. The cost of building and keeping up this class of roads devolves upon the provinces, which may levy tolls by royal decree, and they may also levy a per capita road-tax.

The keeping up of such portions of the National and Provincial roads as pass through a city or village falls upon the commune, the government or province paying over annually to said commune a sum equal to the cost of keeping in repair a stretch of road of equal length near the city or village.

(3) Communal roads, connecting the county seats with the other towns in their districts, those which run through villages, etc., the cost of which devolves upon the respective communes; these expenses are paid out of the communal revenues, or by a special tax levied by the

communes, which have the right to establish tolls, the latter being abolished, however, as soon as they have realized the cost of the roads.

These three classes of roads are invariably macadamized.

(4) Vicerial or Parish roads, the care of which falls to the parishes.

SPAIN.

The most ancient Roman road, outside of Italy, was in Spain, and led from Cartagena (Carthage) to the Pyrenees, where it connected with others crossing the Alps to Rome. An ancient document, said to be the itinerary of Antonius Augustus Caracalla, shows the total number of imperial or military highways in the province of Hispania (Spain and Portugal) to have been thirty-four; the total mileage of these roads was 6,926.

Roads are divided into three classes: Those of the first class (National) being 8 metres; those of the second (Provincial), 7 metres, and those of the third (Rural), 6 metres, in width.

In 1842, a law was adopted which brought into existence a national corps of road-builders, who are employed by the State in building and repairing roads.

Each year the amount to be spent on public roads is fixed, and a specified sum designated for each class, the building of roads being let by contract, or performed under the direction of the engineer corps of the Council of Roads, Canals, and Ports.

The Board of Public Works of each province forms and presents to the provincial assembly plans for the improvement and construction of the principal highways. These plans and accompanying memorials are presented to the Ministro de Fomento, who, after consulting the Council of Roads, Canals, and Ports, decides what shall be granted.

The government of the third class, or Rural roads, is mainly under the civil governor of the province, though final appeal may be carried to the Ministro de Fomento.

It can hardly be said that the present road system of Spain is worthy of emulation, as the power of the Ministro de Fomento to intervene in the construction of even the most unimportant local roads has the tendency to destroy the spirit of local enterprise, which, if left to itself, would probably carry out the projects which it initiates. The manner of conducting labor on the roads is extremely primitive, no machinery being used, the material from cuts and for filling purposes being leisurely carried by hand in baskets from one place to another, instead of being hauled by wagon.

SWITZERLAND.

The mountainous nature of the country, and the severe tests to which the roads are put by the sudden swelling of the watercourses, have rendered road-building of primary importance in this country, and the great

necessity for international communication from France and Germany on the one hand to Italy on the other, tended to further good road construction at an early period.

There exists to-day as well-known traveled routes a number of the old Roman* roads, which have been laid out with as much engineering skill as could be obtained at the present day. Nor were the Roman valley roads through Switzerland less judiciously laid out, or less thoroughly constructed, for they coincide in the main with the leading railway and post routes of the present time.

In the breaking up of society which followed the invasion of the barbarians and the fall of the Roman Empire, the Roman roads, although in continual use, fell out of repair and finally into ruin. The first great construction of the new era was the Simplon Pass, begun in 1800 by the Emperor Napoleon, and finished in 1804. This was followed by the Bernardino (1818–1821), the Splügen (1818–1823), the Julier (1820–1826), the Maloja (1827–1828), the St. Gothard (1820–1830), the Furka, Oberalp, Albula, Flüela, Bernina, Offenberg, Lukmanier (finished in 1876), and the Brünig. These great mountain roads, with the highways following the watercourses, or traversing the lowlands, form the skeleton of the system to which all the lesser local roads are attached.

Mr. S. Bavier, Minister from Switzerland to Italy, published a most interesting work ("Die Strassen der Schweiz") in 1878, on the roads in Switzerland. He estimates the mileage of turnpikes at that time to have been 8,388, or 3 miles of road to every thousand of population. With justice, Mr. Bavier observes that Switzerland's network of highways, extending even to her remotest valleys, constitutes the pride and glory of the land.

The classification of roads in the canton of Zurich, as given below, is generally applicable throughout the country.

The public roads are divided into three classes: To the first class (turnpikes) belong those roads which serve as the means of communication between the larger sections of the canton, embracing several townships, or connecting with similar roads in adjoining cantons.

To the second class (connecting roads) belong those roads which serve to connect the chief sections of a single township with each other, or with first-class roads, or with railway and steamboat stations.

To the third class (side roads) belong all those roads not embraced in the first and second classes, as well as all public footpaths.

The following authorities are competent to take action with regard to classification, construction, and repair of roads, viz: For first-class roads, the Cantonal Council; for second-class roads, the District Council, subject to the Cantonal Council's approval; for third-class roads, the Township.

* Among these Roman roads may be mentioned: the St. Bernard, Simplon, Lukmanier, Bernardino, Splügen, Septimer, and Julier roads.

Laws are rigidly enforced concerning the construction and maintenance of roads, tree-planting, erection of guide-boards, use of wide tires, etc.

UNITED KINGDOM.

Very little art or science in road-making existed in any of the countries of the United Kingdom until about the beginning of the nineteenth century, when John Loudon Macadam and Thomas Telford, both of them Scotch engineers, inaugurated their new systems of road-building, and these are now strictly adhered to as the principal methods of road construction and maintenance.

Over $50,000,000 is annually expended on road construction and maintenance.

ENGLAND AND WALES.

The roads in England were, until somewhat over twenty years ago, under the control and management of turnpike trusts, usually appointed by Acts of Parliament applying to the various districts; these trusts collected tolls and maintained the roads in excellent condition. By Act of 1878 and subsequent Acts of Parliament it is provided:

The duty of maintenance, etc., of highways is cast upon the ratepayers of the parish, and managed by their highway surveyor.

Parishes are united into districts, under the supervision of the highway boards.

In order to raise the necessary funds for the maintenance of the highways, the ratable property value in each parish is ascertained, according to the valuation list in such parish, or, if no valuation list be in force, by the justices of the peace, subject to appeal.

SCOTLAND.

The country road system of Scotland may be deemed as a growth to meet the wants of the public, and its present state of excellence approaches perfection, the Scotch highways being better, as a whole, than those of the other countries of the United Kingdom.

A considerable force of men is continually employed on the roads, the counties being divided into divisions, those being subdivided into districts, and the districts again subdivided into sections, for the purpose of the proper distribution of labor and superintendence, the county surveyor of each county having primary charge of the roads in his county.

A tax-rate of from 6d. to 8d. on the pound (12 to 16 cents on $4.86) is found sufficient for the construction and maintenance of roads.

Toll-roads were abolished by Act of Parliament of 1878 (already referred to under "England and Wales").

Primary importance is given to construction, the roads being built in

the most thorough manner, and, by the system of the proper overseeing of roads, the smallest repairs are not neglected until they assume serious proportions, heaps of road-metal being distributed at easy distances along the roads.

Milestones, which are set in such a manner as to indicate directions by their face surfaces, show the distances to the nearest larger towns, and the newer roads are now constructed for the accommodation of the pedestrian, as well as the driver, by being provided with suitable footpaths, built of cinders, slag, or other easily drained material, and as much attention is paid to their maintenance as to other portions of the roads.

The great Highland roads, though traversing wild mountain ranges and stretches of moorland, are excellently constructed, and easy gradients have everywhere been secured.

IRELAND.

In Ireland, the construction and maintenance of public highways are regulated by the Grand Jury, the counties being divided into baronies, in each of which a Grand Jury Presentment Sessions Court is held biennially, which approves or rejects applications for the construction of roads and bridges, or for the maintenance of existing roads, the County Surveyor meanwhile having prepared plans, specifications, estimates, etc., covering the proposed work, this officer having supervision over all actual work on the highways and bridges. The work, if approved, is let by contract.

Each barony supports its own roads and bridges, except mail-post roads, which are charged one half to the barony and one half to the county at large.

SUMMARY.

At a glance at the conditions narrated in the preceding pages as prevailing in our own country and in Europe, the conclusion is self-evident—that only those States and Countries which exercise a high *central controlling power* over their road and bridge systems have made any advance in the direction of road improvement, and that the *classification of roads*, each class directly governed by a power proportionate to its importance, forms an important feature of highway legislation and management.

The necessity for the employment of proper *engineering skill and superintendence* for purposes of construction and maintenance is also self-evident; and, in this respect, the impracticable, useless, and haphazard system (or lack of system) of tearing up and patching, in vogue in many of our States, cannot be too strongly condemned as a useless

and extravagant expenditure of money, whereby no lasting results are obtained.

To the credit of California, be it said, that these two essentials—a controlling power and road classification—have received legislative attention—first, by the creation of the Department of Highways, and, second, by the designation of certain roads as State Highways; and, with the proper extension of these functions, a permanent system of excellent highways is assured to California.

The excellent highways of Austria, Belgium, France, Germany, Switzerland, and the United Kingdom are attributable to the existence of a proper controlling State or Governmental authority.

State commissions are in existence in the following States: California, New Jersey, Massachusetts, Connecticut, Rhode Island, New York, and Vermont; and the following States may be mentioned as closely following in this direction: Georgia, Kentucky, Indiana, Maryland, Minnesota, New Hampshire, Ohio, Pennsylvania, West Virginia, and Wisconsin.

ADVANTAGES OF GOOD ROADS.

When poor roads prevail in any section, everything else is very apt to be poor—the farmer, the horse, the merchant, the schools. Every day that the public roads are allowed to remain in a poor condition and the streams to remain improperly bridged, the community deals a direct and severe blow to its own interests, and the country will remain undeveloped, its hidden treasures locked up. These roads, if improved and properly engineered, with permanent bridges constructed, would give some signs of permanence of settlement and of contentment with the section; they would induce new settlers to remain; the burden of tax would soon rest upon so many that the roads would be almost self-sustaining; the saving in horses and running-gear would be enormous, and the increased loads that could be sent to market, with a decreased power for draught, would form a substantial increase to the farmer's income. In short, there are few blessings that any community can know equal to that of having first-class roads.

The matter of increased haul is treated of under the heading "Traffic on Country Roads." (See pp. 67–68.) And in this connection, it can truly be said that the United States is handicapped in all the markets of the world, by an enormous waste of labor in the primary transportation of our products and manufactures, while our home markets are restricted by difficulties in rural distribution which not infrequently clog all the channels of transportation, trade, and finance.

It is indeed "passing strange" that we, as a nation, excelling all others in the matter of public improvement, should have the poorest road-system of any stable government.

John Gilmer Speed, in an article on the question of "The Common Road as a Social Factor," says:

> If the common roads had been properly laid out, constructed, and attended to, and their development had kept pace with the development of other highways, I suspect that we would now have other problems to solve than those that confront us.
>
> * * * * * * * * * * * *
>
> We should not have a dissatisfied agricultural population, worried by debt and harassed by care, so that any demagogue with a promising nostrum is listened to with enthusiasm and respect; we should not have the countryside suffer because of a lack of labor, and the poor in the crowded cities suffer from a lack of work.

When the Department of Agriculture, through the Office of Road Inquiry, took up the matter of investigating road conditions in foreign countries, one of the questions asked of our various Consuls was as to what effect improved roads had in increasing land values, etc., and some of the answers given are quoted:

"It is difficult," writes one of our English Consuls, "to arrive at any fact in dollars and cents, relative to the effect of improved public roads upon the value of land or other economic condition, but the effect of such roads now, and for so long in existence, is seen on every hand, and the influence felt in the English mode of life. Englishmen, be they of the gentry or of those in the humbler walks of life, seek their pleasure in and gladly betake themselves to their country homes. The one medium of this pleasure so natural to all men is the solid roadbed over which one can walk, or ride, or drive with equal comfort or pleasure any day in the year."

From Germany comes the response: "It depends on the state of roads to improve the soil, to put to profit the forests, mines, and industrial plants." How applicable are these few words to California! The farmer, with his acres of grain and his orchards of the finest fruit produced in the world, stands as the backbone to our prosperity; the stock-raiser, with his herds of cattle, summered in the lofty Sierras, and driven to the valley for protection during the winter; the mining man, whether exploring for the untold wealth of precious metals that probably yet remains to this day undisturbed in California, or whether taking from its underground channels oil, petroleum, and other natural products in which the Golden State so abounds; the lumberman, felling the timber in our high mountains, all demand good roads.

Of France it is said: "The road-system of France has been of far greater value to the country, as a means of raising the value of lands and of putting the small peasant proprietors in easy communication with their markets, than have the railways. It is the opinion of well-informed Frenchmen who have made a practical study of economic

Effect of Bad Roads. Road Located Below Natural Surface of Country. No Attention Paid to Grading or Drainage.

MUDDY AND ILL-DRAINED VILLAGE STREET, VACAVILLE, CALIFORNIA.

problems, that the superb roads of France have been one of the most steady and potent contributions to the material development and marvelous financial elasticity of the country."

On the "social side" of the road question, Mr. W. H. Moore of St. Louis, Mo., writes:

> The common roads of a country are not only necessary to its development, but their condition is a measure of its civilization. The highest type of mental and moral culture and development cannot be attained without the means of easy and rapid communication between all parts and sections of the country. The railway and telegraph lines are the great modern civilizers of the world; but they are limited in their sphere of usefulness, because they do not reach the farm, the home, the country school-house and church. The common road is the connecting link between these, and without it the progress of a widespread civilization must of necessity be greatly retarded. They are the foundation stones upon which the superstructure of society is erected, and upon which its symmetry, beauty, and stability must rest.
>
> It has been stated by eminent writers that railway and telegraph lines, with the wonderful commercial enterprises they make possible, are in the end detrimental to a country that has no proportionately adequate system of common highways, because of their tendency to congest the population by drawing the intelligent and ambitious portion of the country youths to the cities and centers of commercial enterprise, until the avenues of that class of labor are overcrowded, the wages of labor decreased by undue and unnatural competition, and the surplus set adrift without the means of a livelihood, to become beggars or criminals, instead of delving in the soil from which the primary wealth of the world is secured, and in which avocation there has never yet been a surplus of labor.
>
> Then, too, it is the youthful, intelligent, rugged, and ambitious who are thus being coaxed from the farm, whose society is needed to stimulate the sluggish, who are always content to see the world's great cavalcade go by while they remain in slothful isolation. If these conditions continue, there is danger of a barrier being built up that will destroy that sympathy, intelligence, and coöperation that is so necessary in our mutually dependent condition.
>
> Neighborhoods, counties, and states, separated from each other by barriers of practically impassable roads, in their loneliness degenerate into a condition of moral stagnation, from which it is difficult to arouse them to a common and mutual interest and understanding.

We have already dwelt upon the financial gain to the farmer living in a community where good roads are prevalent, in the way of easy access to markets and shipping points. Viewing the question of road improvement from whatever side one will, its financial advantages can be so strongly set down in facts and figures that they are bound to appeal to any one. When we consider that practically every pound of freight carried by our railroad and steamship lines has previously had to undergo transportation over our country roads in one form or another, is it any wonder that the greatest railroad financiers and managers are strongly in favor of the good-roads movement, and are willing to lend a helping hand to those communities who are alive to their own interests, and who wish to rise up and throw off the yoke of the demon mud? The Office of Road Inquiry has in recent years gone fully into this question, by correspondence with many of the railroad companies of the United States, and some of the letters received by the Department from railroad officials are well worthy of passing note.

A North Carolina official writes, stating the willingness of his railroad to encourage road-building as much as possible, by reducing their lowest freight rate 50 per cent for the transportation of road material, and adds: "The people of our section of country are far from being a prosperous class, and I am afraid it will be long before they will appreciate the importance to them, and the actual saving to them from a pecuniary point of view, to be had from properly constructed roads."

One of the Florida railroads presents a schedule for the transportation of hardpan (which had been found a very useful top-dressing for the sandy roads of that section), varying from one to four cents per ton per mile, according to haul, the rate increasing with decreased length of haul; for example, per carload of 24,000 pounds, distance of 10 miles and under, the rate is $5; between 50 and 60 miles, $11 per carload; between 100 and 110 miles, $15 per carload; between 150 and 160 miles, $18 per carload of 24,000 pounds. And these rates may be given as the general average of figures quoted by other roads, though some have gone so far as to grant free transportation of road-building material in certain cases. The President of the road in question states that "rates quoted have been slightly shaded on account of the interest which the railway has in the progress and prosperity of settlements in a comparatively undeveloped state."

From other railroads in Florida and Tennessee numerous letters of encouragement were received, with offers of liberal reductions in rates for the transportation of road material.

The Superintendent of an Alabama railroad writes: "We shall be pleased to offer special inducements in the way of freight rates, etc., looking to the betterment of public roads, if called upon to do so."

The General Freight Agent of one of the Vermont lines writes, offering half rates for the transportation of road material, and says: "This company is in hearty sympathy with the movement, and, when the time comes, will endeavor to do its share in the good work."

One of the officials of a Kentucky railroad presents a most elaborately prepared table, showing the location of road material along his line, together with the approximate cost of loading the same on board the cars, and further offers the hearty coöperation of the railroad; and an interesting letter along the same lines comes from a Florida railroad official.

The opinion of the Chief Engineer of a prominent railroad in Indiana is worthy of note. He states: "One of the chief obstacles in the way of advancement toward perfecting good roads is the lack of knowledge on the part of persons directing their improvement." He suggests that the fundamental principles of road construction be taught in the public schools. "Teach the boys," he says, "that railroads and steamship lines are the main arteries, and highways the lateral arteries, of com-

merce, and that it is of great importance that the latter be kept up in good condition. Instruct them at the same time how to make and maintain them, and I do not know of anything that will promote faster the improvement of our highways."

The General Manager of one of the leading railroad lines, with headquarters in St. Louis, Mo., writes that in some instances very low rates have been made for the transportation of road material, and, as a general proposition, his line is willing to haul this character of material on the basis of the cost of service for short distances, and for longer distances on the basis of one half cent per ton per mile.

The Chief Engineer of one of the principal railroads in Illinois recommends radical changes in the organizations looking after public highways, and strict engineering supervision over the construction of roads. He favors the imposition of a direct money tax, and condemns the labor system, recommending the improvement of the highways connecting the principal towns as the initial system, after which the construction of lateral and branch roads should be taken up. The President of the same railroad writes: "We have at times made reduced rates in special cases, to encourage the building of roads in which our company was vitally and directly interested. * * * We have also in several cases paid our local taxes for perhaps a year, or two years, in advance, by furnishing materials from the company's gravel pits and transporting the same." He recommends legislation whereby the railroad companies may be allowed to furnish such material and transportation in lieu of taxes, *in advance* of the time when the taxes become payable, and adds that the road question should be taken up by the Federal Government and by each individual State on as broad grounds as its interests may dictate. "The reason for the present bad condition of highways in many parts of this country seems to me to lie in the lack of coöperation over sufficient areas, each little township working in its own interests, regardless of those of its neighbor, and each land-owner working out his tax on the road at the season of the year it suits him best, and in a way which his ignorance of the importance of the subject leads him to think cheapest. While I do not profess to have any knowledge of what the best system is, I am clear that nothing could be worse than the present *lack* of system. You are perfectly right in referring to the interest uniformly shown by railway managers in the improvement of highways."

From Michigan come responses, agitating legislation putting the control of roads under a State commission.

In California, the Southern Pacific Company has accorded most liberal reductions for the hauling of the output of the rock-crushing plant at Folsom.

And not alone does the farming, or country, community reap the

benefits of good roads. Money paid out among the farmers is applied to the fountain-head of all business, and from there it will ultimately flow downward, filling all the channels of trade, production, and finance. The commission men in our cities, handling the immense output of fruit from our orchards; the grain-brokers, buying and shipping our wheat; the transportation companies, shipping the products of the farm by rail and water; the wagon-makers and implement-dealers, supplying the farmer; the commercial world, trading with the farmer; the public at large, enjoying the benefits of good city markets, accessible from the country, where fresh farm produce can be purchased at reasonable rates; the wheelman; the tourist; the owner of driving and riding stock, or horseless carriages—all will receive their full share of the benefits.

Another direct benefit to the land-owner is the increase in the value of property resulting from highway improvement. Granting that increased land value means increased taxation, would the farmer who has once enjoyed the benefits of good roads be willing to retrograde, to give up the pleasures he derives from good highways, to decrease his earnings by the necessity of a larger outlay for horses and rolling-stock, and to adopt the "penny-wise and pound-foolish" system, just to save a few dollars in extra taxation? If there be such a one, let him sell his farm at its advanced value, and betake himself to some native wild whose tranquillity has never been troubled by the spirit of progress.

A most interesting phase of the road question, with respect to its advantages, socially and morally, has been applied to it by the Government, in the question of free rural mail delivery. The Postoffice Department, which has reached a wonderful degree of perfection in the United States, stands ready and willing at all times to give equal service to all classes and to every section of the country in the distribution of mails, provided the department can do so within the restraints of its appropriations and incomes. The educational influence of the daily paper, the ability of the farmer to keep in constant touch with the market fluctuations and prices, and other comforts and conveniences, would naturally follow in the wake of free rural delivery.

First Assistant Postmaster-General Perry Heath, who has been an earnest advocate of the establishment of a system of free rural delivery, after citing the advantages, in the way of increased value of farm lands reached by mail routes, and in the tendency to improve roads that would naturally follow, writes:

> To these material advantages may be added the educational advantages conferred by relieving the monotony of farm life through easy access to wholesome literature and the keeping of all rural residents, the young people as well as their elders, fully informed as to the stirring events of the day. The moral value of these civilizing influences can not be too highly rated.

As a partial solution of the labor problem, also, the road question presents itself. The number of idle men, forced to beg and, almost, to steal to "keep the wolf from the door," would be materially decreased; the public wards of charity and the inmates of our county jails and state prisons would be lessened, were a broad and liberal system of road-building and improvement introduced.

And, in conclusion, again quoting from Mr. W. H. Moore's able remarks on "The Social, Commercial, and Economic Phases of the Road Subject":

> The road question is resolving itself into a plain problem of competition. The State or Nation that does not build modern ways of communication can not successfully compete in the markets of the world. * * * Every State of the Union should have a settled policy on the kind of roads it shall construct, and every county see to it that no citizen be allowed to represent it in the legislative halls of the State without a pledge to work faithfully for the enforcement of such policy. Then, and not until then, will the condition of our public roads cease to remain discreditable to our country and a menace to our further development and civilization.

THE CONSTRUCTION AND MAINTENANCE OF ROADS.

LOCATION.

The first and most important object to be considered is that of location, which is too often done in a haphazard manner, ultimately leading to expensive maintenance.

Under this heading must be considered, primarily, the points to be connected and the topographical features of the country to be traversed. It is only in very rare and exceptional cases that a road location can be advantageously traced in a direct line between two points, even when they would be separated by but a short distance. It is generally necessary to deviate in order to avoid difficulties, to take advantage of the most economical location for bridges, and, if possible, to so locate the road as to the adaptability of the country for good roadbed, preference being given to location which will bring into proximity supplies of road-building material, such as gravel beds, stone deposits, etc.

GRADES.*

It is hardly realized that only 41 per cent as much can be hauled on a grade of 5 feet per hundred as on a level earth road; that on a 10 per cent grade this is reduced to 26 per cent, and to 10 per cent on a grade of 15 feet to the hundred; or, to put it in another way, the energy required to haul a given load one mile on a grade of one foot to the

*See Tables of Grades, pp. 66-67 of this Report.

hundred is the same as is required to haul the same load a mile and a half over level road, while this increases to three miles and a half on a 5 per cent grade, and to six miles on a 10 per cent grade. *The profile and alignment of a road should be a compromise between directness of route and an easy gradient.*

The saving in maintenance of a road, if properly graded, is also very considerable, as the velocity of storm-waters is naturally lessened by a decrease in gradient, thus reducing the danger of washouts and the expense of repairing the same.

It is therefore well for the road-builder to bear these figures and facts in mind, and to consider them in road location. The primary cost of the construction of a road, located with due regard to gradient, even in the most unfavorable locality, where materials and labor are high, is of but little consideration as compared with the immense saving gained by increased load and lessened energy necessary to haul.

It is a hard matter to set down in exact figures the maximum grade that should be followed, as authorities, though agreeing on the fact that the less the grade the more economical is the road, differ as to what should be exactly the greatest allowable grade at all consistent with proper economy in maintenance, but it is generally considered that the grade should not exceed 1 in 40, or 2½ per cent, if it can possibly be avoided. But in no case should a properly constructed highway, whatever the conditions be, have gradients in excess of ten feet to the hundred, and this only in very short stretches. It is also argued by many that a rolling road—that is, one having very slight grades up and down in alternate stretches—is preferable to one constructed on a dead level, inasmuch as the slight grade facilitates drainage of surplus water.

DRAINAGE.

Due care must be exercised toward drainage of the roadway, proper regard being given to adjacent property, in order that storm-waters may not cause damage to cultivated lands, etc., adjoining the roadway, and that the overflow may be disposed of in such a manner as not to stand in the side ditches, causing damage to subgrade, but that it be conveyed to the nearest natural watercourses, if possible; and especially should the matter of thorough drainage receive attention where the road is entirely "in cut," bringing the surface of the road below the natural level of the adjoining country. This can be accomplished by digging side ditches of proper slopes (not steeper than 1 foot vertical to 1½ feet horizontal) to convey the water until it can be disposed of. (See Fig. 2, which illustrates this method of side-ditching.)

These ditches should be carefully looked after, to see that they do not get choked or washed away, and, so long as the natural growth of grass on their sides and bottom does not interfere with the free passage of

Type of Poorly Drained Road. Kern County.

water, the roots and sod should be allowed to remain, as they form a natural lining to the ditch, and prevent an excessive percolation of water. Weeds, however, should be cut, particularly large and noxious ones.

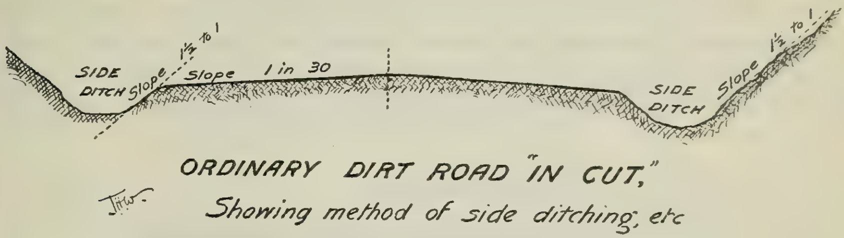


FIG. 2.

In soil of a boggy nature (which, however, seldom occurs in California), and where expense will permit, "blind" drainage is advocated, constructed in the following manner: A side ditch should be dug to a depth of 2 to 3 feet below the center of the road. In the bottom is placed a 6-inch vitrified pipe, surrounded by broken stone and covered with dirt. Second quality of pipe may be used, and on account of 6-inch pipe being a standard size, there is always a large surplus of "seconds" available, which the manufacturers are willing to dispose of cheaply. Care must be exercised in the proper laying of the pipe, an even grade being maintained and the joints properly made. If pipe cannot be secured, flat stones can be laid in such a manner as to form a fairly good drain, but precaution must be taken to avoid the danger of scouring at the bottom of such a drain, as a cave-in will result, with consequent clogging of the ditch.

The accompanying diagrams illustrate various styles of drains and culverts.

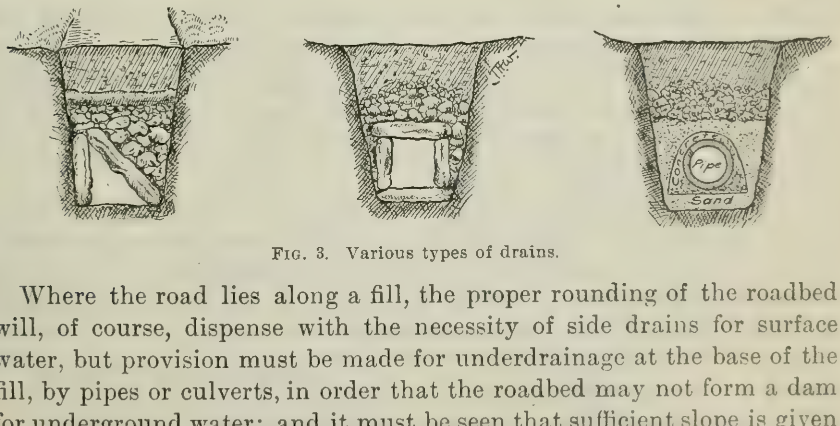


FIG. 3. Various types of drains.

Where the road lies along a fill, the proper rounding of the roadbed will, of course, dispense with the necessity of side drains for surface water, but provision must be made for underdrainage at the base of the fill, by pipes or culverts, in order that the roadbed may not form a dam for underground water; and it must be seen that sufficient slope is given to the sides of the fill to prevent washing. The inclination should not be over 45 degrees.

When the road is partly in cut and partly in fill, as in the case of a hillside road, the outside water will take care of itself, but side drains should be placed on the inside (or cut) and relieved of their water by cross-drains running across and underneath the roadway at intervals. These should be constructed, if possible, of vitrified pipe, laid in the manner already described, or, where the volume of storm-water is such as to demand it, larger culverts should be placed. Suffice it to say, that it is invariably cheaper to build these of a substantial and lasting character.

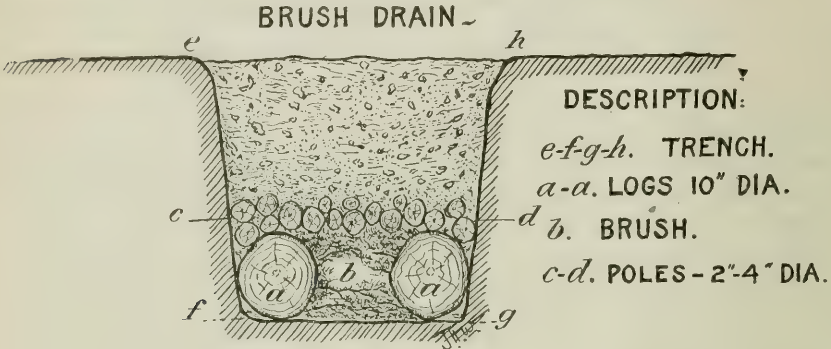


FIG. 4.

ABUNDANCE OF ROAD MATERIAL IN CALIFORNIA.

Along practically all of our mountain roads, stone is abundant, and can be used in the form of dry masonry for culverts and retaining walls. Yet, we see this natural store of material too often ignored, and expensive wooden culverts built (usually unnecessarily large), lasting, at the best, for only a few seasons, to be rebuilt in the same manner as before. If local overseers of roads were only to exercise some ingenuity in the way of applying to roads the materials which nature has so lavishly provided in most localities of this State, a wonderful degree of betterment at a slight expense—in fact, at an actual saving—would be attained, and the constant necessity for patching and repairing would be greatly diminished.

The following table, naming some of the road-building material occurring in each county in the State, has been compiled by the Department after careful examination of the localities mentioned. It is by no means exhaustive, but is sufficient evidence of the great store of road-building material lying within our State:

Alameda	Chert, limestone, basalt, trap, and metamorphic rock; gravel.
Alpine	Basalt, silicious and metamorphic rocks.
Amador	Bowlders, cobbles, gravel, limestone, basalt.
Butte	In mountainous portions, large variety of stone; in valley portions, [clay, gravel, sand.
Calaveras	Basalt, limestone, cobbles, bowlders.

Colusa	Basalt, lava, gravel, sand, clay, hardpan.
Contra Costa	Basalt, limestone, chert, jasper, gravel, shale.
Del Norte	Bowlders, cobbles, silicious and metamorphic rocks; gravel.
El Dorado	Volcanic and metamorphic rocks, basalt, limestone, gravel, cobbles, bowlders.
Fresno	Gravel, hardpan, sand, clays; volcanic rocks in mountains.
Glenn	Gravel, trap, basalt.
Humboldt	Gravel, trap, basalt, limestone, bowlders, cobbles; some asphaltum.
Inyo	Silicious and volcanic rocks; gravel, clay.
Kern	Bitumens, asphalts, clays, adobes, sand, volcanic and metamorphic rocks.
Kings	Asphalts, volcanic rocks, clays, sand.
Lake	Trap, basalt, shales, gravel.
Lassen	Basalt and other volcanic rock; limestone, gravel.
Los Angeles	Disintegrated granite, porphyry, limestone, gravel, cobble, clays, etc.
Madera	Gravel, clays, adobe, sand; volcanic rock abundant in mountainous portion.
Marin	Basalt, trap, gravel, metamorphic rock.
Mariposa	Quartzite, volcanic rock, gravel, metamorphic rock.
Mendocino	Basalt, trap, silicious shale, etc.
Merced	Sand, alkaline clays, adobes, gravel.
Modoc	Basalt, trap.
Mono	Metamorphic and silicious rocks.
Monterey	Bitumen, limestone, gravel.
Napa	Volcanic rocks, including basalt; gravel, silicious shales.
Nevada	Volcanic and metamorphic rocks; gravel, cobbles, etc.
Orange	Gravel, asphalt.
Placer	Basalt, trap, limestone, shale, bowlders, cobbles.
Plumas	Volcanic and metamorphic rocks; gravel, silicious shale.
Riverside	Porphyry, limestone, disintegrated granite, metamorphic rocks.
Sacramento	Cobble, bowlders, gravel, trap, granite.
San Benito	Shale, volcanic and metamorphic rocks, limestone.
San Bernardino	Limestone, bowlders, gravel, clay.
San Diego	Cobbles, gravel, bowlders, limestone, basalt, trap.
San Francisco	Chert, jasper.
San Joaquin	Volcanic rocks, gravel, clays, adobe, sand, hardpan.
San Luis Obispo	Bitumen, asphalt, trap, shale, chert, gravel.
San Mateo	Chert, limestone, bowlders, jasper.
Santa Barbara	Cobbles, bowlders, gravel, limestone, bitumen, asphalt.
Santa Clara	Gravel, asphaltum, volcanic and metamorphic rocks, jasper, silicious shales.
Santa Cruz	Volcanic, metamorphic, and bituminous rocks, gravel.
Shasta	Gravel, bowlders, cobbles, volcanic rock.
Sierra	Volcanic and metamorphic rocks, cobbles, bowlders, gravel.
Siskiyou	Trap, basalt, quartzite, limestone.
Solano	Excellent basalt, gravel.
Sonoma	Basalt, trap, gravel, cobbles, bowlders.
Stanislaus	Gravel, clays, sand, hardpan, bowlders, cobbles.
Sutter	Clays and adobes, sand, cobbles, bowlders, volcanic and metamorphic rocks.
Tehama	Basalt, trap, cobbles, bowlders, gravel.
Trinity	Volcanic and metamorphic rocks, bowlders.
Tulare	Alkaline clays, adobes, sand.
Tuolumne	Quartzite, volcanic and metamorphic rocks.
Ventura	Cobbles, gravel, asphalt, bitumen, limestone, silicious shale.
Yolo	Gravel, cobbles, bowlders.
Yuba	Volcanic and metamorphic rocks; cobbles, gravel.

To sum up what has already been said regarding location, drainage, etc., before starting on the actual construction of the road itself:

(1) See that proper drainage is provided;

(2) Remember that economy in maintenance depends on an easy gradient; and

(3) Remember that hilly roads are full of danger, expensive to maintain, and destructive to horses.

These preliminary provisions having been carried out, the actual roadbed should be graded up to a proper convexity and thoroughly compacted by rolling, either by horse- or steam-power.

CROWN, OR CONVEXITY, OF ROADBED.

The crown of the road, or slope from the center to the sides, is merely for the purpose of insuring proper drainage by providing a way by which the water will be carried to the side drains; and, if a reasonable height of crown is exceeded (as is very often the case) the tendency is to throw passing traffic toward the sides of the road, where large, flat surfaces are formed, in which the water collects and stands, leaving a high ridge in the center. On ordinary dirt roads, it is generally considered that the slope from the center to the sides should not exceed half an inch to the foot, while this should be lessened on macadam roads to a third of an inch, increasing slightly with the grade. That is, on a dirt road 16 feet wide, the slope should be 4 inches from crown to ditch, and on a macadam road of the same width from 3 to 4 inches is all that is necessary; the "crowning" of the roadway decreasing with a decreasing grade. In other words, the slope of the crown should exceed the grade of the road, in order that surplus waters may run to the side ditches rather than down the roadway.

WIDTH OF ROADS.

The width of the road naturally depends upon the amount of traffic likely to pass over it; and, in the construction of country roads especially, width is too often given precedence over length; that is, we too often meet with comparatively unimportant roads, say, 30 feet wide, or over, only half worked over their entire width, when 8 or 16 feet of *surfaced* roadway would answer all purposes of traffic, and could be thoroughly kept up at the same or less cost. (It is recommended that multiples of 8, rather than multiples of 10, be considered as standard widths for roads, the reason being that 8 feet is generally considered the space taken up by the ordinary wagon in traveling, so that a 16-foot roadway gives room for two wagons to pass, and on a 20-foot surface there is a useless surplus for this purpose.) The right of way secured, however, from fence to fence of adjoining property, should never be less than 30 feet, as future development of the country traversed is likely to lead to serious expense for further condemnation unless a sufficient width of roadway is secured in the first place. This width will allow

for the proper construction of side ditches and foot- or bicycle-paths, besides leaving 20 feet of driving space, of which it is necessary to surface, in some cases, only a very small portion. Of course, the surfaced space should be proportionate to the amount of traffic passing over it. Where the travel is light, the surfaced portion need be but 8 feet wide, but where there is a larger amount of traffic, which would necessitate a too frequent turning out of passing vehicles and a consequent wearing of the dirt shoulders, this width should be increased to 16 feet, which will generally answer all purposes, even on the most frequently traveled country roads.

DIRT ROADS.

In the construction of what are commonly known as dirt roads, the nature of the soil exposed in grading and cutting should be carefully studied. Ordinary earth, when properly packed, will stand considerable wear; but, where soft clayey substance is encountered, provision should be made for some kind of surfacing, and especial attention paid to subdrainage. Sand is often used for this purpose, and if properly laid, mixed, and rolled, forms a fairly good road surface. Gravel, however, is preferable; but, in laying this, it should be seen that no stones of excessive size, such as large water-worn cobbles, are used, and it is well to allow some binding substance to adhere to the stones in order to secure firmness and cohesion. (See article on "Gravel Roads.") As has already been pointed out, the conditions in California are favorable to road construction and maintenance. Nature has been extremely lavish in providing natural road material throughout the State, and even the most remote country roads are seldom far removed from sources of good road-building material.

STONE ROADS.

What has been said above, as to drainage, etc., applies also to roads that are to be surfaced with road-metal. Experience has proved that there is no more general cause of the destruction of roads than soft foundations. A firm, dry, and solid substratum is absolutely necessary for the surfacing material to rest on.

In surfacing a road, the broken stone or other material used is merely a protection or roof to the foundation, and, while the surface receives the wear of passing vehicles, the weight is borne by the foundation, which, if improperly constructed and not thoroughly drained and packed, will be upheaved and depressed, no matter how much care has been exercised in the actual work of surfacing. Therefore, the foundation is of the utmost importance, and should be thoroughly drained, packed, and settled before any surfacing material is laid, and, especially in the case of deep fills, it is advisable, if possible, to let them become

perfectly compact by the action of traffic and the rains before surfacing is attempted. If it is found impracticable to delay surfacing for a season after the fill is made, every precaution should be taken to guard against uneven settling. The earth should be spread on in layers of not more than a foot in depth, and rolled and tamped as solidly as possible.

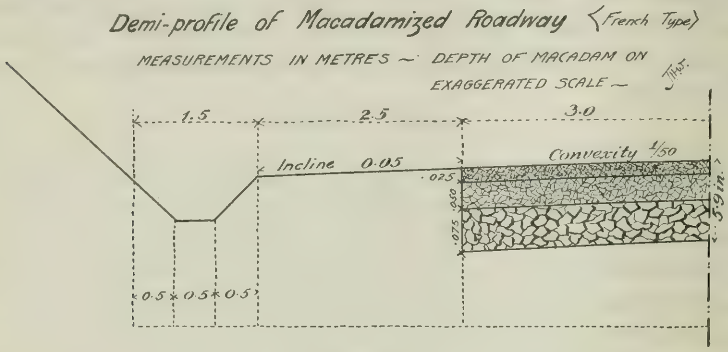


FIG. 5.

The foundation should be conformable in convexity to what will be the surface of the road when completed; that is, the thickness of the surfacing material should be uniform throughout the width of the road.

In regions where stone is abundant, there has been found no material so well adapted to the surfacing of country highways. Macadam's principle was to "put broken stone on a road which shall unite by its own angles, so as to form a solid hard surface."

The stones should be so laid that the entire width shall form the segment of a flat ellipsis, the arch of which shall be of the proper convexity, so as to assist the water to pass from the center to the sides, and thus contribute to the drying of the road, by allowing the action of the sun and air to produce a great degree of evaporation.

As the principle of Macadam is to unite the stone by its own angles, the broken rock should be spread in layers of even sizes, starting at the bottom with a course of stone not over 2½ inches in diameter, and not smaller than 1½ inches. This insures thorough packing when rolled, as the larger stones will fit one another more closely than if mixed with the smaller. After the roadbed has been thoroughly prepared for the reception of the road-metal, the No. 1 (or larger) stone should be laid on it to a depth of 4 to 5 inches. It should be carefully spread by shovel, and not carelessly dumped out of the carts on to the roadbed. This should be well rolled until an even surface and a uniform thickness of stone are obtained over the roadbed. When properly rolled, the stones will form a layer about one fourth less in thickness than when laid loosely by shovel; in other words, if 4 inches of No. 1 stone are laid by

shovel on a foundation, this should shrink to about 3 inches after proper rolling. After the first layer has been thoroughly rolled, the second layer, of stones from $\frac{3}{4}$ to $1\frac{1}{2}$ inches in diameter, is laid on in the same manner as the first, and, when rolled, should be about 2 inches thick. Too much stress cannot be laid on proper rolling. Roll and re-roll until thorough compactness is secured. Do not roll from the crown of the road, but start on the sides. On top of the No. 2 stone is finally placed the binding course, or screenings, which should be wet down and rolled. Care must be observed in wetting down that too much water is not used, as this has a tendency to wash the foundation.

The following rules for the construction of stone roads have been compiled and issued by the Massachusetts Highways Commission, and are well worthy of careful study:

When possible, roll the sub-grade with a steam-roller.

If the sub-grade is too sandy to roll, cover with coarse gravel laid on to a depth of 3 inches, or as much more as may be needed to give a good foundation. Fill any depressions with the same material till the surface is true and even.

All broken stone must be rolled in screened layers.

After spreading the first course of broken stone, begin rolling at the sides, and continue thus by running ahead, so as to allow from 2 to 5 inches of the driving wheel to pass over the shoulder, and backward with the outer edge of the driving wheel from 5 to 10 inches inside the edge of the broken stone. Roll until the stone ceases to "wave" in front of the wheels, and until it seems firm under foot as you walk over it. Next, begin on the other side, and roll in the same manner. Then work toward the center until the stone is rolled. Roll each layer of stone in the same manner.

If the road shows a wavy motion after passing the roller over it three, four, or more times, it may indicate too much moisture in the sub-grade. If, on examination, you find this to be true, stop rolling and move ahead, allowing the sub-grade to dry out. With some coarse, hard granite rocks it has been noted that after the roller passes over them a few times they begin to "crawl" and the sharp edges break off. A slight sprinkling of sand or stone screenings, or water may prevent this. Try one after another of these means until the work progresses to your satisfaction. You must not expect to prevent the stone from shaking as you walk over it, but you need to continue the rolling until the fragments of stone adjacent to where the foot presses do not move as you walk. Most of the rolling must be done before you spread the screenings. After spreading the screenings, water and roll until the mud flushes to the surface. You cannot expect to prevent the stones from kicking out if teams pass over the road. Keep watch, and in a few days have the roller pass once or twice over the road, after watering, until the loose stones are pressed down out of sight.

Before spreading any broken stone, great care must be taken to have the sub-grade carefully shaped and thoroughly compacted.

All shoulders must be shaped and left sufficiently high to roll to the proper grade before any broken stone is spread on the road.

In the case of heavy fills, you must not run the roller to the edge of the shoulders unless the fill has had time to settle. Work out slowly on this kind of work.

In every case, the screenings used on the surface as a binder course must be of the same material as the top course of the road.

Excepting where it may be needed to compact hard granite rocks, as above referred to, you will use water only on the top, or binder, course.

You will wet this binder course thoroughly before rolling, but not to the extent of saturating the foundation. You will get better results and prevent the screenings from being picked up by the wheels of the roller if you apply the water and allow it to settle down below the top surface before passing the roller over it. Too much water, or too little, will give trouble by causing the surface to be picked up.

You must not under any conditions roll the screenings when dry.

You must not under any conditions allow teams to pass over the road after the screenings are spread and before they are rolled.

In case of a deficiency in the water-supply, you may have the screenings spread and await a rain before rolling; but in such case the road must be entirely closed to travel, and the rolling must be begun as soon as the road is wet, and continue until the section covered with screenings is thoroughly compacted. In such cases, it may be necessary to operate the roller day and night, and you must insist on this being done.

GRAVEL ROADS.

Gravel, if properly laid and rolled, makes an excellent road, and, though it will not pack so closely at first as macadam, with proper care and attention to repairs it will ultimately become almost as solid as a stone road. It should be laid similarly to macadam, the larger pieces having been first separated from the smaller by screening; no piece should be used larger than 2 inches. The first course is formed of a layer of about 3 inches of gravel from 1 to 2 inches in diameter, thoroughly rolled and wet down; on this should be spread the second course, of gravel from 1 inch down, to a thickness of about 3 inches, and the whole thoroughly sprinkled and rolled. Avoid using large cobbles for this purpose; they will not pack, and will invariably in time work up to the surface.

THICKNESS OF LAYERS OF SURFACING MATERIAL.

As has already been pointed out, the surfacing of a road is merely to serve as a roof to protect the sub-grade, or foundation, from wear by passing traffic and from washing by rain. So long, therefore, as a practically impervious surfacing is laid, any increase in its depth is unneces-

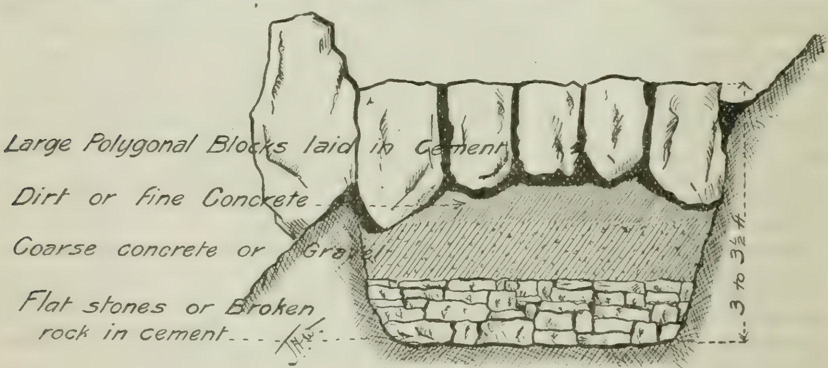


FIG. 6. Section of Roman road.

sary, and is so much money buried in broken stones. As will be seen from the accompanying diagrams, the old Roman roads were of immense thickness as compared with our modern macadamized highways, being paved with large blocks on top, and underneath this lay a substratum of three layers, the first being of dirt, the second of small broken stones or gravel, and the lowest layer of larger-sized broken stone.

The late eighteenth century road was very much reduced in thickness, the Telford principle of foundation of large flat stones set on end being used as a substratum, with broken metal placed on top.

The modern macadam road of about 6 inches in thickness has been found all-sufficient everywhere, and will withstand the heaviest traffic put upon it, if properly laid and cared for.

FIG. 7. German type of Telford road.

MAINTENANCE.

To no other industry can the old adage that "a stitch in time saves nine" be better applied than to road-building. The smallest hole or depression will soon become a large and expensive one to repair if neglected. If, on the appearance of depressions, a few shovelfuls of gravel or broken stone are deposited, the passing traffic will soon settle the material in place; but, with neglect, the hole or depression increases in size at an astonishing rate, as water will invariably collect there after rains, will soak into the road, soften the roadbed, and the horses' hoofs will do the rest.

A sure index to the weakest parts of a road is its condition after a heavy rain. Careful examination of those parts of the roadbed where the water collects should be made, with a view to draining the same, either by the placing of proper culverts or ditches or by leveling up the low spots.

ROAD-SPRINKLING.

As water, if not properly disposed of by a thorough system of drainage, is the great destroyer of roads, so is it, if properly applied by sprinkling, a great preserver. The wear of passing traffic is bound to disintegrate the surface of even the most thoroughly macadamized highway, and the wind will soon carry these particles away, cutting large trenches in the road, and exposing the substratum to ensuing rainstorms and further wear by passing vehicles. In many counties of the State road-sprinkling is receiving due attention, while in others, even where water can be easily procured from natural watercourses, or wells or ditches along the road, sprinkling is neglected, and the road allowed, literally, to blow away. Dusty roads are not only an exhibition of neglect, but are a source of extreme discomfort and inconvenience to travelers, and are a positive injury to orchards and grainfields lying adjacent to the road.

USE OF OIL ON ROADS.

It may be of interest to note that oil has been used for sprinkling, or surfacing purposes, with quite a degree of success, especially in Los Angeles and San Bernardino counties. It has been found, not only to prevent dust, but to form a water-proof covering for the roadbed. With the recent discovery and development of large oil-fields in this State, it is recommended that this work be continued in those sections where the expense will warrant it, as, if properly applied, the coating will last a considerable length of time, and the necessity of sprinkling with water will be done away with. In applying the oil, it must be thoroughly mixed with the dust. Mere sprinkling will not thoroughly impregnate the dust, but forms a cake on the surface, which adheres to the wheels of passing vehicles, and the road's "last state is worse than its first." The crude oil (preferably mixed with mineral pitch) should be spread on the road in furrows, and thoroughly incorporated with the dust by raking. The road should then be sprinkled with water and thoroughly rolled. Various mechanical devices for performing this work have attained quite a degree of perfection in the southern part of this State, and an examination of the roads treated with oil shows the process to be worthy of encouragement and further experiment.

The use of oil is also recommended in the construction of the subgrade or foundation of stone or gravel roads, where the substratum is of a soft or spongy nature, a thin layer of dry earth being spread over the oil-sprinkled surface, and well rolled before the road-metal or gravel is laid.

WIDE TIRES.

The matter of wide tires is receiving marked attention, not only in their use being advocated by promoters of good roads, but in their voluntary use by farmers and others engaged in teaming, even in localities where no regulations exist compelling their use. Wagon manufacturers in all sections of the country report a growing demand for wide tires every year, and, once used, the wide tire is never departed from. Were the people only to realize the immense benefit that would accrue to themselves by the use of broad tires, legislation would be unnecessary in this direction.

The wide tire is not only a road-maker and road-preserver, but a long series of experiments, carefully conducted over roads of all classes and in all conditions, have gone to show that the energy necessary to draw a given load on a wagon is greatly lessened where wide tires are used, and that a given energy will haul a largely increased load. Experiments have demonstrated that a given load on a 1½-inch tire drew about 40 per cent heavier than when on a 3-inch tire, the draught being on a fairly stiff grass sod. On a moist, but hard road, the 1½-inch tire drew

from 12 to 15 per cent heavier than the 3-inch. (See "Wide Tire and Narrow Tire Tests," page 65.)

Ordinary farm wagons should be equipped with tires at least 3 inches wide; and it has been found successful in this respect to so lengthen the rear axle that the rear wheels will run about an inch outside of the front wheels, thus rolling a larger surface, and distributing the load more evenly over the road.

In many of the States, laws are in force regulating the width of tires, some of them compelling the use of a certain width of tire for a prescribed load, others allowing rebates in the way of tolls, taxes, etc., where tires are of a certain width. In almost all European countries, and especially in those where particular attention is given to the proper care of roads, the use of narrow tires is positively forbidden.

The following is a brief summary of some of the laws governing the width of tires in the various States and in foreign countries:

CALIFORNIA.

(Chapter 206, March 16, 1889, Sec. 25, Art. 39.) Boards of Supervisors in their respective counties have power to enforce regulations concerning size of wagon and width of tires.

MICHIGAN.

(Act approved June 8, 1883; amended May 12, 1897.) All persons who shall have used only lumber wagons with tires of not less than $3\frac{1}{2}$ inches in width, for loads exceeding 800 pounds, shall receive a rebate of one fourth their assessed highway taxes, provided such rebate shall not exceed in any one year three days' road-tax for any person.

NEW YORK.

(Statutes of 1893, Chapter 468.) Every person who uses wagons carrying a load of 1,000 pounds, and with tires of not less than 3 inches in width, shall receive a rebate of one half of his assessed highway tax for each year, not exceeding, however, in any one year $4, or four days' labor.

By law of May 10, 1894, Chapter 686, laws of 1892, was amended by adding Article 79: In counties where the expenditure for road purposes exceeds the sum of $500,000, the Board of Supervisors may enact laws regulating the width of tires of vehicles built to carry a weight of 2,500 pounds or upward.

In Queen's County, N. Y., all vegetable wagons, weighing when loaded 2,500 pounds or more, shall have tires of not less than 3 inches in width.

OHIO.

(Act approved April 20, 1894.) It shall be unlawful for any person to transport over any road, in any vehicle having a tire of less than 3

inches in width, a burden of more than 2,000 pounds. County Commissioners are empowered to employ suitable persons to see to the enforcement of this law.

(Passed March 6, 1894.) In counties of a population, on the census of 1880, between 33,510 and 33,515 (this applies to Scioto County), the following regulations may be enforced by the County Commissioners: All vehicles carrying a load between 2,500 and 3,500 pounds must be provided with tires not less than 3 inches wide; those carrying a load between 3,500 and 4,000 pounds must have tires not less than 3½ inches in width; between 4,000 and 6,000 pounds, the minimum width is fixed at 4 inches; between 6,000 and 8,000 pounds, 5 inches; and over 8,000 pounds, 6 inches.

INDIANA.

Indiana has a law against hauling on a wet gravel road a load of over 2,000 pounds on a narrow-tired wagon, or over 2,500 pounds on a broad-tired wagon.

KENTUCKY.

On the toll-roads, the rate for a loaded narrow-tired wagon drawn by four horses is 40 cents; for a wagon with a 4-inch tread, under same conditions, 35 cents; narrow-tired wagons with five animals, 60 cents; wagons with 4-inch tread, 50 cents; narrow-tired wagons with six animals, 75 cents; wagons with 4-inch tread, 60 cents.

VERMONT.

R. R. Sec. 3135 prescribes a minimum width of tire of 3 inches for wagons loaded with burdens of between 3 and 4 tons, and if carrying more than 4 tons the tires must be at least 4 inches wide.

MASSACHUSETTS.

All vehicles are exempt from taxation, if furnished with tires proportioned to the weight of the wagon according to the following schedule: Wagons weighing not less than 1,000 pounds nor more than 1,500 pounds, to have tires not less than 3 inches in width; from 1,500 to 2,000 pounds, 3½-inch tires; 2,000 to 2,500 pounds, 4-inch tires; 2,500 to 3,000 pounds, 4½-inch tires; 3,000 pounds and over, 5-inch tires.

AUSTRIA.

In lower Austria, a width of wheel rim of 4½ inches is required for loaded wagons drawn by two or three horses, and in Bohemia the same regulation is in force. All wagons built for a load of more than 2¼ tons must have wheels with rims at least 4½ inches in width in Styria and Carinthia; and if built for more than 4½ tons (in Styria) or more than 3½ tons (in Carinthia), the rims of the wheels must be at least 6¼ inches wide.

FRANCE.

All freighting and market carts must have tires from 3 to 10 inches wide, usually from 4 to 6. (This applies to two-wheeled carts.) The 4-wheeled wagons very seldom have tires less than 6 inches wide, and the rear axle is usually longer than the fore, so that the hind wheels run about an inch outside of the level rolled by the fore wheel. (This plan is recommended elsewhere in this Report.)

GERMANY.

The Act of April 16, 1840, prescribes that wagons for heavy loads, such as coal, brick, earth, or stone, must have a width of tire of at least 4 inches, and shall have a flat and not a rounded surface. Light vehicles must have tires at least 2½ inches wide.

SWITZERLAND.

Wagons must be provided with wheels having tires of a width proportional to the largest load admissible. Two- or more horse wagons shall have a width of tire not less than 1 inch for each draught animal. Vehicles for transportation of heavy objects which cannot be taken apart must have tires not less than 6 inches wide.

CANADA.

In Ontario the width of tire shall not be less than 2½ inches for a load of from 500 to 1,000 pounds on each wheel. For loads of from 2,000 to 3,000 pounds to the wheel, each wheel shall have a width of not less than 6 inches.

ROAD STRUCTURES.

Road structures, ranging in size from the small cross-drains and culverts, to large bridges spanning streams, form an important and considerable item of expenditure in the construction and maintenance of a highway system.

The use of cement or vitrified clay pipe is strongly recommended for the construction of drains and culverts from 6 to 24 inches in size, and the old-style wooden boxes, which have to be continually replaced, necessitating the tearing up of the roadway, should be done away with. If vitrified pipe is used, care must be taken in laying it, a proper grade being given to the trench, that water may run through freely, and danger of clogging be averted. Sand has been found to be a most effective material for the bed of clay or cement pipe, as, when properly packed, it has absolutely no shrinkage or settling qualities. All joints should be carefully made of cement mortar, and, if possible, the pipe should be jacketed with concrete, to a thickness of from 2 to 4 inches. The accompanying sketch shows the best form for such a jacket. Dirt should then be gradually filled in and carefully tamped.

Where small natural watercourses are encountered, culverts should be constructed of stone, cement, or brick masonry. If this be found too expensive, however, and it is necessary to use wooden planking, the sides of the watercourses should be prevented from washing by the construction of walls of masonry (laid dry, if necessary), thus insuring a solid foundation for the planks to rest on.

Iron and steel bridges should receive careful attention, all metal-work being kept painted and free from rust, and, if floored with wood, should be protected with a coating of asphalt or other material.

Stone bridges are gradually coming into use in California, and are not only permanent, and inexpensive to maintain, but are very attractive in appearance. Their cost, while primarily comparatively high, compares most favorably with that of wooden and metal structures, as a good stone bridge will last for ages, and the cost of maintenance is practically *nil*, while other structures require constant expensive repairs and renewal, and, at the best, their life is but short.

A large single-arch bridge of 81 feet span has just been completed by the Department on the Lake Tahoe State Wagon Road, crossing the American River near Riverton, El Dorado County. It replaces an old combination truss bridge, which is giving way and is unsafe for travel in its present condition. (The iron-work, which is in a fairly good state of preservation, will be used in the construction of a truss bridge at a less important point on the road.) The material used is a fine quality of granite, quarried near by.

Reference is made to the accompanying plates, showing the bridge in course of construction, and plans taken from the drawings accompanying the specifications.

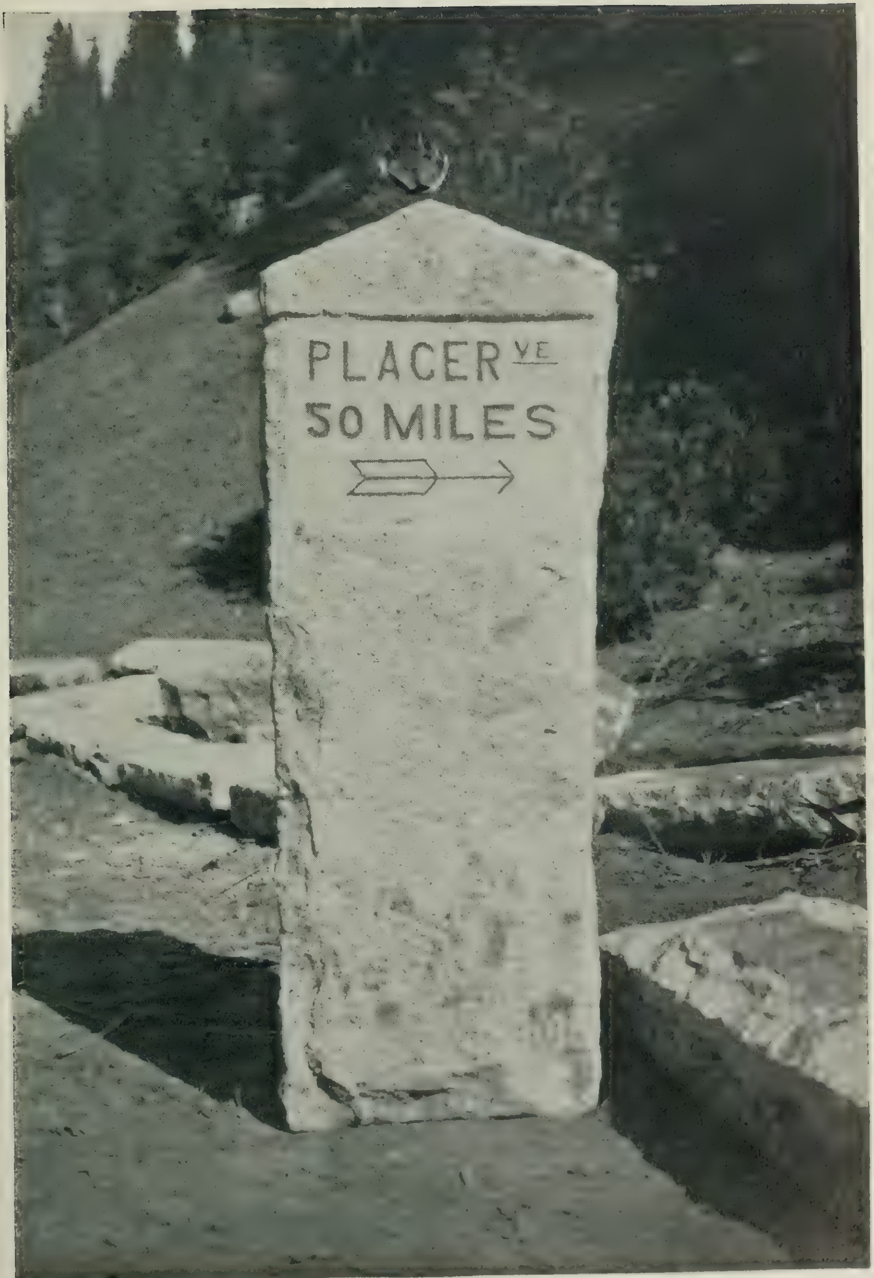
MILESTONES AND SIGN-BOARDS.

The accompanying cut illustrates the milestones as set on the Lake Tahoe Wagon Road; they are about 18 inches wide, 6 inches thick, and 54 inches high, of which 18 inches are set in the ground. They are cut from granite, roughly hewn, a smooth face being dressed for the cutting of the legend and arrow, indicating mileage and direction to Placerville, the county seat and nearest railroad town.

Sign-boards should be placed at all intersections of roads with another, indicating the direction and distance to nearest towns or cities, and rigid laws should be enforced for their protection. The practice of shooting at them and otherwise defacing them, or of turning them around in such a manner as to deceive or confuse the traveler—this latter being thought by some people to be a "funny trick"—should be treated with severe punishment, as are other cases of wanton misuse and destruction of public property.

Construction of New Stone Bridge at Riverton, Lake Tahoe State Highway, Showing Old Combination Truss Bridge.

New Bridge (Course of Construction), Riverton, Lake Tahoe State Highway. Longest stone-arch span (81 ft.) on Pacific Coast.



Granite Milestone, as Erected on Lake Tahoe State Highway.

It would be well to have a portion of the County Road Fund set aside for the erection and maintenance of such monuments. Their absence and neglect are of too frequent occurrence in this State.

ROAD MACHINERY.

The success of any work depends upon the use of proper tools and machinery as much as it does upon the employment of skilled mechanics, artisans, and laborers; and, before good roads can be made, the community must be furnished with the proper implements. While many of the counties of the State are fairly well provided in this respect, others are so situated financially that the purchase of improved road machinery would be quite a burden. It is, therefore, recommended that State aid be furnished in this respect, by the purchase of improved road machinery, such as first-class graders, rollers, and portable rock-crushers, which may be loaned to the various counties where need for them is seen to exist.

GRADERS.

Road-plows, graders, and scrapers are of such universal use that passing notice only may be given them. They form an important factor, however, in the primary work of road construction, as, with proper manipulation, one machine, with the necessary complement of men and horses, will perform an amount of work equivalent to a very large body of men working with hand tools.

Judgment, however, must be exercised in their use, especially as to the season of the year when grading should be done.

In California, where the season of rainfall is usually well marked, it should not be a hard matter to fix the proper time for the grading of roads. Grading should be started, if possible, immediately prior to the first rain-storm of the season; but too often do we see the destruction of a fairly good piece of road by unseasonable grading. The local road overseer will delay until spring, by which time the heaviest rains have usually fallen, and will then start on his work of grading, leaving the road to be settled by the late rains, which are generally insufficient, and, by summer time, the road is covered with a thick coating of dust. By starting the grading of a road early in the rainy season, the benefit of the settling effect of all the rainfall is received and the road can be thoroughly worked and rolled when it is moist.

The principal work performed by the grader is the crowning of the road and the digging of side ditches. These matters have already been treated of.

ROLLERS.

The importance of the proper rolling of roads has been already dwelt upon. If the roller is not used, the surfacing material is in a continual state of disturbance; the angles are worn round, and compact consolidation becomes impossible.

One of the most important auxiliaries to road-making was the introduction of the steam-roller by M. Polonceau in 1834. The use of rollers weighing more than 12 tons is being discontinued, as the ordinary 12-ton roller may be loaded to 15 tons, and a weight in excess of this has a tendency to crush rather than to consolidate the road-metal. Very few bridges in this State can stand the weight of a 20-ton roller.

Horse-rollers, weighing from 2 to 6 tons, are very serviceable, and much good work can be performed by them on ordinary dirt roads, or those having slight surfacing only, where a heavy steam-roller is unnecessarily expensive.

ROCK-CRUSHERS.

Portable rock-crushers are very convenient in utilizing material that happens to lie along the road or in the vicinity, and especially would they prove serviceable in California, where good road-building material is so abundant. They can be used as the work progresses, so that the source of supply may never be any considerable distance from the road under construction.

Various forms of portable rock-crushers are manufactured, of a capacity of from 75 to 300 tons per day; they require a steam-engine of from 5 to 10 horse-power to run them. 100 tons of crushed rock is sufficient for the laying of 2,500 square feet of macadam, 6 inches thick, when packed and rolled solid.

ROAD RECORDS AND MAPS.

It is as essential that every county should have a complete record of its roads that it is that a railroad company should have maps and records of its rights of way; and in those counties where deeds do not exist or cannot be found, conveying rights of way for roads that are in use (and there are many such instances), steps should be taken to secure the necessary quitclaims, so that future litigation may be prevented, and that the county may have power to resist encroachments on its rights of way.

A thorough map system, in sheets on a scale of, say, four inches to the mile, covering each county, should be prepared, showing, by conventional signs, the direction of the road, its length between various courses, width, material composed of, nature and ownership of adjoining property, locations of water and road-building material, locations of milestones, sign-boards, bridges, culverts, railroads, waterways, etc., and sufficient contour lines should be drawn to indicate the watershed of the road. A system could easily be devised whereby these features could be indexed, reference being made to fuller descriptions contained in deed-books, records of culverts and bridges, etc.

In laying out the tracing of a road, preliminary to actual survey, the United States Geological Survey charts are very useful in such localities as have been covered by this survey.

PHASES OF THE ROAD QUESTION.

CONVICT LABOR.

Condemnation to labor on the public roads was a form of punishment for misdemeanor in many of the Eastern States during the eighteenth century, but it was abandoned early in the present century, and not taken up again until in recent years. The system of working convicts on the roads has been found successful in some of our States—notably in North Carolina, Georgia, Tennessee, and Kentucky.

It is argued by some that their employment is in direct competition with free labor, though those States that have adopted measures for convict employment claim that exactly the reverse is the case; that this is the only manner in which convicts may be employed in which their work does not come in direct competition with free labor, and that it is certainly more advantageous for the community to have the roads improved by those for whose support they pay taxes than to have to pay taxes both for the improvement of the roads and for the support of the convicts also.

In this connection it is interesting to note the conditions existing in other States:

In North Carolina the law of March 7, 1887, provided that when any county has made provision for the working of convicts on its county roads, the Judge holding court in such county may sentence to imprisonment and hard labor on the roads the following classes of convicts: First, all persons convicted of offenses the punishment whereof would otherwise be wholly or in part imprisonment in the common jail; second, all persons convicted of crimes, the punishment whereof would otherwise wholly or in part be imprisonment in the penitentiary for a term not exceeding ten years. In such counties there may also be worked upon the public roads all persons sentenced to imprisonment in jail by any magistrate, and also insolvents who may be imprisoned for non-payment of costs in criminal cases, a rate of compensation to be fixed for the work of the last-named class. Provided that no person who has been convicted of and sentenced on a charge of murder, manslaughter, rape, or arson shall be assigned under this law. Each county is charged with the keeping and proper custody of the convicts while at work, and must pay all expenses of transportation to and from the penitentiary.

Another law, similar in its effects and provisions, was ratified by North Carolina, March 11, 1889.

From information gathered by Professor J. A. Holmes, State Geologist for North Carolina and Secretary of the State Road Association in 1895, it appears that the General Assemblies of the State, in the years 1867, 1873, 1875, 1877, 1879, and 1889, have made provisions for the use of convicts upon the roads in case any county should desire it; and their employment has been an important factor in inducing counties to vote a tax for the improvement of roads. Statistics gathered from eighty counties in the State show that the average cost of the maintenance of a convict, while confined in the county jail, is about 30 cents per day; while returns from a number of counties employing this class of labor show that the cost of maintenance is reduced to a general average of about 24 cents while they are at work on the public highways.

In all cases, the convicts are carefully described and photographed; they are offered certain inducements in the way of awards and shortening of terms for the faithful discharge of their duties, and are allowed to visit their homes from Saturday night until Monday morning.

The general result has been that but few convicts have attempted to escape; that their health has been improved; that the cost of their maintenance has been lessened, and that their labor, under skillful supervision, has proved much more efficient than that which can be hired by the prevailing rates.

The Road Law of Delaware (Chapter 670, 1893) provides for the purchase by the Levy Court of New Castle County of a stone quarry producing material suitable for macadam, and for the employment therein of persons convicted of such crimes as obtaining money under false pretenses, carrying concealed weapons, gambling, lottery, assault and battery, disorderly conduct, vagrancy, etc. The law further provides for an equitable distribution of the quarry product.

Along this line, viz: the employment of convicts in the preparation of road material, the following other States have enacted laws: Iowa, New York, New Jersey, and California.

It will be noted that in the Southern States only prisoners convicted of the lighter class of crimes, or "short term" prisoners, are worked publicly, and it should be remembered that, as a rule, the inmates of the Southern penal institutions are of a different character to those in this State. The convict lease system is still prevalent in many of the Southern States, and, in the words of General Roy Stone, Special Agent and Engineer, Office of Road Inquiry, U. S. Department of Agriculture, "in Southern States, where the convict lease system, with all its objectionable features, still prevails, it is clear that a transfer of prisoners from irresponsible and often inhumane private employ to the care of States or counties would be a saving kindness to them, while it would wipe out a public disgrace and benefit the entire community."

*When the proposition of working convicts on the public highways of New York came before the Prison Association of that State, it was emphatically denounced by such well-known penologists as Edward B. Merrill, James McKeen, Lispenard Stewart, Felix Adler, John R. Thomas, Benjamin Ogden Chisholm, and Frederick G. Lee, in that:

1. Such employment of convicts would as seriously interfere with labor outside the prisons as any other form of convict labor.

2. The State convicts could only be employed on State roads, unless there was a violation of the law which prohibits the employment of convicts under contracts. If the counties employed them, they would be obliged to make a contract with the State for them.

3. A very large body of keepers would be required to prevent escapes; escapes would frequently occur, and there would be a constant necessity for shooting convicts in order to prevent their getting away. There would soon be a death-rate among our convict population approaching that known to have existed among the convicts of the South who are employed on public works.

4. In many cases the prejudice against convict labor would require a military force to protect the convicts who are at work.

5. (*a*) It has been found a hardening and demoralizing process to the convicts themselves to employ them in public places; (*b*) and it has been found by penologists to be a demoralizing process to the public at large to see this daily spectacle of shame.

It is the opinion of the Department that, so far as California is concerned, the most feasible solution of the question has already been reached in this State, by the employment of convicts in turning out crushed rock for highways, and in quarrying and cutting stone for highway structures and other public improvements, within the walls of the penitentiary. For about five years quarries of trap-rock and granite have been worked, and a large stone-crushing plant has been operated, at Folsom State Prison, and the product distributed throughout the State, public works having the preference, while the surplus, if any, may be sold to any one applying for it. In this way the convicts are engaged in turning out a product the use of which encourages public improvement and causes a demand for free labor; natural sources of fine stone are made use of which could not be made available in any other manner, and the prisoners require no extra guard, and are screened from public view, being employed within the walls of the State Prison.

The Department does not advocate the employment of convict labor in California in any other manner than that now in vogue.

*Bulletin 16, U. S. Department of Agriculture, Office of Road Inquiry.

TRACTION TESTS.

A most interesting series of experiments in traction was made by the United States Department of Agriculture at the Cotton States and International Exposition in Atlanta, Ga., in 1895 (at which your Commissioner was present, as the representative of the California Bureau of Highways).

The tests were made over three styles of roads—a macadam road, a sand road, and an ordinary dirt road. The macadam road was 300 feet in length, made up of six 50-foot stretches, the first one level, and the other stretches rising to 2, 4, 6, 8, 10 per cent grades. It was constructed of broken stone, 6 inches deep and rolled by a 15-ton steam-roller. The other roads were 200 feet long, with 50-foot stretches, the first level, and the succeeding ones rising 2 feet, 4 feet, and 6 feet in the hundred, respectively. The sand road was constructed of 6 inches of river sand, laid on a natural clay bed, neither the bed nor the surface being rolled; while the dirt road was made by the grading up of natural earth. This was thoroughly wet, and deep ruts formed on it by passing a heavily loaded narrow-tired wagon over it a number of times, the object being to make the last two mentioned roads conform as nearly as possible with the average sand and muddy roads, respectively, prevalent throughout the State.

A heavy farm wagon, loaded with cotton bales, each weighing about 500 pounds, was drawn successively over the various forms of road, and the amount of pull indicated by a machine known as the "tractometer."

The following is given as a result of the experiments:

On the smoothest possible macadam road surface, the force of traction was not constant, but changed continuously within a range of 50 pounds.

On the ordinary dirt road, the force varied from absolute zero to 700 pounds (in a gross load of 3,000 pounds), becoming in effect a rapid succession of violent jerks.

On heavy grades, in the case of the smooth road, the force was more nearly constant.

The force necessary to start a load on the smooth road was four times as great as the force required to draw the load at a uniformly slow pace when started, and was one tenth the gross load.

The force required to start a load on the dirt road was about one fourth the gross load, or not greatly in excess of the upper limit of the tractive force when the wagon was in motion.

From these observations the following conclusions are drawn:

A team harnessed in the ordinary way is subjected to a continuous jerking motion, which, on even the smoothest country road, is enough to greatly increase the fatigue.

On a dirt road in bad condition this jerking motion becomes a succes-

sion of heavy blows transmitted to the animal by means of the collar. The fatiguing effect of these blows is probably double that of a steady pull equal to the maximum figure reached in the oscillations, and, furthermore, they bruise the shoulders of the team, thus lessening its value, besides being cruelly painful.

Starting a heavy load is also equivalent to a heavy blow, as the driver ordinarily holds his team well back, and then urges it suddenly forward against the collar held by rigid traces.

The smoother the road, the more nearly constant will be the force of traction, and the less will be the fatigue of the team while doing the same amount of work; that is, if a load four times as great can be drawn over a smooth road as over a rough one, by exerting the same amount of force, then a team can haul four times as much in the same time over the smooth road and suffer much less fatigue in the same operation.

Some method should be adopted of making a more elastic connection between the wagon and the team, thus transmitting the shocks at the wheel rims as a gradual change of force to the team.

During these experiments, a team of small mules readily drew twelve bales of cotton (6,000 pounds) on a heavy Studebaker wagon up the 10 per cent grade of the macadam road, the tractometer indicating a pull of 1,000 pounds. The same team was stalled completely in going down the 6 per cent grade of the sand road, after pulling the indicator to 1,900 pounds. Nine bales of cotton were removed before the load could be again got in motion. The driver refused to venture at all upon the dirt road with the twelve-bale load.

On summing up the records, it was found that about four times as much force was required to draw one ton over the level stretch of the mud road as over the level stretch of the macadam.

WIDE-TIRE AND NARROW-TIRE TESTS.

A number of experiments in this direction were also made at the Atlanta Exposition, and it was found that on a wet clay road twice as much pull was exerted to draw a loaded wagon over part of the road which had been cut up by a heavily-loaded narrow-tired wagon as was necessary to draw the same load over part of the road which had been previously traversed a number of times by a wagon with 5- and 6-inch tires.

The following is a brief summary of the tests made with wide and narrow tires by the Missouri Agricultural Experiment Station; the net load in each trial being 2,000 pounds, and the tires 1½ and 6 inches wide:

1. On macadam street, a load of 2,518 pounds can be hauled on wide tires with the same draught that is required for a load of 2,000 pounds on narrow tires.

2. Gravel road. Except where wet and muddy on top, the draught on wide-tired wagons is very much less than that on narrow-tired wagons. Average: 2,482 pounds could be hauled on wide tires with the same draught required for a 2,000-pound load on narrow tires.

3. Dirt roads. (*a*) When dry, hard, and free from ruts, the weight hauled on wide tires was 2,530 pounds, as against 2,000 pounds on narrow tires with the same draught. (*b*) With a depth of from 2 to 3 inches of dust, the test was unfavorable to broad tires. (*c*) On clay road, muddy and sticky on the surface, but firm underneath, the result was also unfavorable to the wide tires. (*d*) On clay road, with mud deep and drying on top, or dry on top and spongy underneath, 3,200 pounds could be hauled on wide tires with the same draught as was required to draw 2,000 pounds on narrow tires. (*e*) On clay road, surface dry, but with deep ruts formed by narrow tires, the first test with wide tires showed an excessive draught over that of narrow tires running in their own ruts, but succeeding tests with the broad tires, which gradually eliminated the ruts caused by the narrow tires, showed a lighter draught than that required for the narrow tires, and demonstrated the effectiveness of wide tires as road-makers and road-preservers.

4. A large number of tests on meadow, pasture, stubble land, and plowed ground in every condition, from dry, hard, and firm to very wet and soft, show without a single exception a large difference (from 17 to 120 per cent) in favor of the broad tires. (See article on "Wide Tires," page 54, of this Report.)

TABLES OF GRADES, ETC.

The following tables, already referred to under the head of "Grades" (page 43), are taken from Byrne's Highway Construction. Table No. 1 shows a comparison of the loads that may be hauled over various grades and surfaces, taking 1.00 as unit of load; while the second table shows the equivalent number of miles of level road that a given load may be hauled over with the same amount of draught that is required to move it over various grades:

TABLE No. 1.

Table Showing the Relation Between Load, Grade, and Surface.

Grade.	Earth.	Broken Stone.	Stone Blocks.	Asphalt.
Level	1.00	1.00	1.00	1.00
1:100	.80	.66	.72	.41
2:100	.66	.50	.55	.25
3:100	.55	.40	.44	.18
4:100	.47	.33	.36	.13
5:100	.41	.29	.30	.10
10:100	.26	.16	.14	.04
15:100	.10	.05	.07	----
20:100	.04	----	.03	----

TABLE No. 2.

Table Showing the Relation Between Length of Haul and Grade.

Rate of Grade per 100 ft.	Equivalent Length of Level Road.	Rate of Grade per 100 ft.	Equivalent Length of Level Road.
	Miles.		*Miles.*
0.0	1.000	2.50	2.244
0.25	1.121	2.75	2.363
0.50	1.242	3.00	2.484
0.75	1.373	4.00	2.982
1.00	1.500	5.00	3.444
1.25	1.622	6.00	3.986
1.50	1.746	7.00	4.844
1.75	1.871	8.00	4.982
2.00	2.000	9.00	5.480
2.25	2.120	10.00	5.977

TRAFFIC ON COUNTRY ROADS.

The following figures are taken from data collected and published by the United States Department of Agriculture:

1. Average length of haul from farms to market or shipping points: Eastern States, 5.9 miles; Northern States, 6.9 miles; Middle States, 8.8 miles; Cotton States, 12.6 miles; Prairie States, 8.8 miles; Pacific Coast and Mountain States, 23.3 miles; in the whole United States, average 12.1 miles.

2. Average cost per ton of 2,000 pounds per mile: Eastern States, 32 cents; Northern States, 27 cents; Middle-Southern States, 31 cents; Cotton States, 25 cents; Prairie States, 22 cents; Pacific Coast and Mountain States, 22 cents; whole United States, average 25 cents.

Average total cost per ton for whole length of haul: Eastern States, \$1.89; Northern States, \$1.86; Middle-Southern States, \$2.72; Cotton States, \$3.05; Prairie States, \$1.94; Pacific Coast and Mountain States, \$5.12; whole United States, average \$3.02.

It will be seen from the above figures that the length of haul in the Pacific Coast and Mountain States is far in excess of that in other portions of the United States, being almost double the average haul, while the cost is just a little below the average, making the average total cost per ton for whole length of haul two thirds more than the general average; and it is the opinion of the Department that, so far as these figures apply to California, it is an extremely conservative estimate.

What portion of the total cost of haulage is chargeable to bad roads can be deduced to a certain extent from the following information furnished by our Consuls in foreign countries:

In Belgium, in the provinces of Brabant, Hainaut, and Namur, the average cost is given at 9⅝ cents per ton per mile, while a leading agriculturist in Belgium furnishes the following figures: One horse can

haul 1,000 kilograms (2,204 pounds) over and above the weight of the wagon or cart, 15½ miles, and return with a load in one day. The keep of the horse amounts to 4 francs ($0.772) per day, and the wage of the driver varies, according to locality and season, from 3 francs to 5 francs ($0.57 to $0.965) per day. For the purpose of comparison, applying prevailing rates in California (viz: keep of horse, 40 cents, wages of driver, $1.75 per day, a total of $2.15) we find that 2,204 pounds can be hauled 31 miles in one day, or at a rate a little over 6 cents per ton per mile (figuring 2,000 pounds to the ton).

In England, the cost of hauling to market is from 8 to 12 cents per mile per ton, the average two-horse load being 4,480 pounds.

In France, it is not unusual to find one horse hauling over two tons, and the cost is figured on the basis of one horse hauling 2,000 kilograms (4,408 pounds) 20 kilometres (12½ miles) a day, returning unloaded. Again, applying the rate of $2.15 per day ($1.75 for driver and 40 cents for horse), the result is that one ton of 2,000 pounds can be hauled one mile in France for 7.8 cents, applying California rates of pay of man and keep of horse. This increases to 12 cents when the haul is materially lessened.

In Germany, in the consular district of Frankfort-on-the-Main, a fair average for all seasons is 16 cents per ton per mile for a distance of 5 miles or less, from which figure the rate declines proportionately to 10 cents per ton per mile for a haul of 12 miles.

The following figures apply to Hanover (Germany): Haul of 6 tons for two horses, average distance 10 miles per day. Figuring cost of keep of two horses at 80 cents, and pay of driver at $1.75 per day, we find that 6 tons can be hauled 10 miles for $2.55, or at a rate of 4¼ cents per ton per mile.

In Brunswick (Germany), the average cost is given at 11 cents per ton per mile; in Plauen, 13½ to 15 cents; in Mannheim, 12 cents; and in Munich at 5 to 7 cents per ton per mile; (average load in Munich, 11,000 pounds for two horses).

In Switzerland, the average one-horse wagon is constructed to carry 4,400 pounds, and a two-horse wagon 8,800 pounds. The average draught-horse travels 24 to 28 miles a day on the Swiss roads, with a load of 12½ quintals (2,755 pounds). Figuring this on the basis of $2.15 per day (California rates, as given above), the average cost per ton per mile is found to be 6 cents.

The increase in cost of haulage and the decrease in weight which can be hauled by a given number of draught animals are by no means the only losses by bad roads. The loss of perishable products for want of access to market, the failure to reach market when prices are good, and the failure to cultivate products which would be marketable if markets were always accessible add many millions to the actual tax of bad roads.

Extension of Tioga Road—Character of Country over which Line Runs.

Camp C. F. Curry, Tioga Survey. Elevation, 10,318 Feet.

WORK OF THE DEPARTMENT.

Assuming office on the 25th day of May, 1899, there were found two appropriations in the State for road construction: One for the extension of the Tioga Road to the Mono Lake Basin, and the other for the Lake Tahoe State Wagon Road. Neither appropriation was, however, immediately available.

TIOGA ROAD.

Your Commissioner was also, ex officio, a member of the Yosemite National Park Commission, being associated on this commission with Colonel Samuel M. Mansfield, Corps of Engineers, and Captain Harry C. Benson, Fourth Cavalry, U. S. Army. Proceeding to Wawona, California, your Commissioner joined his conferees, and, during the months of July, August, September, and October, made thorough examinations of the roads leading to and through the Yosemite National Park and the Yosemite Valley, and more particularly of the three proposed routes for the extension of the Tioga Road to the Mono Lake Basin, the Tioga Road lying within the National Park.

These routes are known as the Levining Creek route, the Mill Creek route, and the Bloody Cañon route. The report of said commission is submitted herewith, as of special interest to the State of California.

Much interest has been displayed by various parties living to the east of the Sierras in the three various routes for the extension of the Tioga Road. The Mill Creek route, as may be seen from the report of the National Park Commission, was too expensive; the Levining Creek route, while possibly less expensive, is so situated as to be filled with snow earlier in the fall and later in the spring than the Bloody Cañon route; and the Bloody Cañon route also gives a shorter line for travel from the Mono Lake Basin to the San Joaquin Valley than any other route, and one which can be traveled for a much longer period of the year on account of its freedom from snow.

During the past summer an engineering corps was taken into the field, which carefully surveyed the Bloody Cañon route for an absolute location of the proposed roadway, a detailed account of which follows:

The field party assembled at Sacramento City, June 6, 1900, and proceeded by railroad to Hawthorne, Nevada; thence by team to Farrington's ranch, Mono County, California, where it was met by your Commissioner June 9th, and field camp was immediately established. The party was organized as follows: One chief of party, one levelman,

two chainmen, one rodman, one back flagman, two axmen, and one cook. Work was begun June 13th, at Farrington's ranch-house, situated in the northwest corner of Section 34, Township 1 north, Range 26 east, Mount Diablo base and meridian, and a survey line through Bloody Cañon and over what is known as Mono Pass was run, until August 25th, when the survey closed, at a point on the Tioga Road, west of Dana Creek Fork, at the foot of Mount Gibbs, and west of the junction of Mono Pass trail with the Tioga Road, Tuolumne County, California.

A complete topographical survey of the line was made from Farrington's ranch to the Tioga Road. All natural features, such as creeks, lakes, streams, etc., were located, also limits of wooded and cultivated areas, and all houses, fences, trails, and roads.

The line was also cross-sectioned, and every point located from which to prepare an accurate topographical map, drawn to five-foot contours. A line of levels was run from the base, or bench, marks established by the United States Geological Survey.

In selecting this line, it was considered the most feasible and practicable route for an outlet for the inhabitants of that part of the country who are now virtually cut off from communication and from the markets of the State.

From Farrington's ranch-house the line runs through a varied and picturesque country for a distance of 17 miles, where it connects with the Tioga Road. Out of these 17 miles 4.73 miles are either broken or solid rock, the remaining 12.27 miles being of a character easily worked, and presenting no difficulties in the construction of the contemplated highway.

The line also runs on that side of the mountain most exposed to the sun, which would free it from the winter snows, and open it to through travel earlier than any other pass. One cannot commend this route too highly. In opening this road the State would be benefited by having a leading artery, connecting a large, fertile portion of the country, which is now entirely cut off from communication by the difficult and sudden rise, to surmount the almost impassable barrier of the eastern slope of the Sierra Nevada Mountains.

The trail, which now crosses the summit of Mono Pass, and is used occasionally, rises 2,770 feet in a distance of 2½ miles, which is equivalent to a grade of 1 vertical foot to every 4.76 feet horizontal; but in places, the trail rises 300 feet perpendicularly to 100 feet horizontally.

To convey a better idea of this deep and dangerous pass—dangerous mostly on account of the rock, which is hard, small and loose, making it extremely difficult for animals to retain their footing—photographs were taken, forming part of the survey record, some of which are reproduced herewith.

On this surveyed line, and as shown in the drawings in the office of the

On the Mono Pass Trail, Line of Extension of Tioga Road.

Department of Highways, the grade would not generally exceed 5 per cent, or a rise of 264 feet per mile. To obtain this grade, it was necessary to get distance to surmount the summit of the Pass. This was accomplished by carrying the line along the east side of Mount Parker, through pine timber and over mountain soil. The line continues through this character of country until the solid rock above the timber belt is reached, at an elevation of 9,226 feet. From here to the summit, a distance of 2.67 miles, the proposed route traverses a country abounding in either large broken, or solid, rock, and represents the only part of the line expensive to construct. From the summit to the connection with the Tioga Road, the country traversed is gently rolling, rich in pasture and spruce timber.

TENAIYA CANON ROAD.

In connection with the Bloody Cañon route, your Commissioner desires to call attention to the advisability of the construction of a road from Lake Tenaiya to the Yosemite Valley. It might be thought at first glance that this is a "tourist" route; but such is not the case. By the construction of the road through Bloody Cañon, the Tioga Road is tapped at what is known as the Dana Meadows. Thence following the Tioga Road, Lake Tenaiya is reached at a distance of about 15 miles. From Lake Tenaiya, the Tioga Road passes over the shoulder of Mount Hoffman, and thence by a circuitous route to Hodgden's, where the Big Oak Flat Road is joined. In this distance, many heavy grades are encountered and high altitudes reached, which, lying, as they do, in the very heart of the Sierras, are covered with snow a large portion of the year. All of this can be avoided by the construction of a roadway through the Tenaiya Cañon, which would pass by easy grades to the floor of the Yosemite Valley, avoiding snow, and saving a distance in travel of 50 miles, thus making a short route from the east to the west of California.

A large portion of this road lies wholly within the limits of the Yosemite Valley, where only the State can construct roads. If the roadway is ever constructed, it must be a charge upon the State. Not only will this roadway open a short route from the east to the west, but it will also open up to the people of California a most magnificent scenic section within the State, excelled in no other part of the world. The Lyell and Dana glaciers, equal to those of Switzerland, will then be within easy access of the tourist, while the high mountains, with their rugged peaks, with their forests, meadows, and waterfalls, will be accessible to all.

LAKE TAHOE STATE WAGON ROAD.

Attention is invited to the report of Commissioner Marco Varozza, hereto attached, for a detailed description of the work of maintenance of this road, which was carried on under the direction of and inspected by the Department.

In addition to the maintenance fund of $8,000, there was appropriated by the Legislature of 1899 the sum of $25,000 for the construction of permanent bridges and culverts along this highway. The most important feature of this work has been the construction of a large stone bridge over the North Fork of the American River, at Riverton, replacing an old iron and wood truss bridge, now almost gone to decay. Detailed description and plans of this bridge appear elsewhere in this report. Retaining walls and smaller bridges have also been constructed along the road, at points where the same have been found necessary, and a large number of clay-pipe culverts have been placed. There is an abundance of excellent material lying along this road, in the way of trap-rock, granite, etc., and by the use of this material, crushed by a portable rock-crusher (should the State purchase one), the facilities for the construction of an excellent road cannot be excelled elsewhere in the State. It is of the utmost importance that this road should continue to be maintained by the State, as the amount of travel along it between California and Nevada fully justifies it.

Owing to recent important changes in the road, it has been found necessary to re-survey it along its entire route.

Work was begun on September 26, 1900, and the distances given are from the center of the court-house situated in the town of Placerville, in Section 8, Township 10 north, Range 11 east, Mount Diablo base and meridian, from which point to the eastern city limits over the present traveled road is a distance of 1.663 miles.

From this point, which is situated in the center of the county road and on the eastern boundary line of the town of Placerville, a line was run over the said county road, and the various topographical features noted.

At a distance of 3.109 miles, the road crosses the El Dorado Deep Gravel Mining Company's ditch, which said ditch is at the junction of the Newtown and Lake Tahoe Wagon Roads, in Section 10, Township 10 north, Range 11 east, and which is also the west boundary line of that part of the old Placerville and Lake Tahoe Toll Road deeded to the State of California, and of which a map, with field notes, was recorded and filed in the office of the Secretary of State the 30th day of June, 1896. On the former survey, it is to be regretted that no permanent monuments were established, making it necessary for the Department to retrace the entire line of the road. Granite monuments have been now established about every 1,000 feet along the present course, and, so far

Lake Tahoe State Highway, Showing Remains of Old Corduroy Road.

Lake Tahoe State Highway, Showing Bed of American River on Right.

as the survey has progressed, milestones have been erected. (See detailed description, p. 58.) Owing to the early storms, it was found necessary to disband the surveying party on October 31, 1900, after having surveyed 25 miles of the road.

Careful notes have been made of various points of the road that may be bettered by the placing of culverts, changes of grade, etc., and, though work was necessarily delayed on general maintenance of the road during the season, the condition of the road is better than could generally be expected. On account of the numerous short turns, and owing, in places, to the character of the soil due to the mountainous country traversed, it has been found necessary to drain the road with numerous culverts. These culverts, formerly of wood, are being replaced as rapidly as funds will allow by permanent structures of stone and vitrified pipe; and it is recommended that sufficient funds be allowed for the prosecution of further work of this nature.

GENERAL EXAMINATIONS.

Besides having directed the survey of the Tioga and Lake Tahoe roads, your Commissioner has personally examined a number of proposed highway routes throughout the State, recommendations regarding which appear hereafter.

The Department has made analyses of road material submitted to it, has furnished advice to various inquiring counties, has examined maps and plans submitted to it. Boards of Supervisors, commercial institutions, and bodies of representative men, generally, have been conferred with, and meetings of citizens have been attended throughout the State, notably in Stanislaus, in Santa Barbara, in Solano, and in El Dorado counties. A most important Road Convention was attended in Los Angeles in the month of October, 1900, at which numerous papers and addresses were presented on various phases of the road question. A permanent organization, "The Southern California Good Roads Association," was effected, and resolutions were adopted embodying the deliberations and opinions of the convention. Legislation was recommended, covering State aid, classification of highways, an ad valorem tax, etc.

ADVICE TO BE FURNISHED COUNTIES.

While it has always been one of the chief aims of the Department of Highways to coöperate most heartily with the various counties in the State in the matter of road improvement, and to furnish advice on questions of road- and bridge-building, its work in this respect has been somewhat hampered during the past two years by the meagerness of the appropriations furnished it. It is the earnest desire of your Commissioner to enlarge the scope of the Department's work in this respect, to such an extent that all counties desiring tests of materials, bridge plans,

and advice in various directions regarding road construction, may be availed of these benefits.

In many counties, where it is necessary to build bridges, engineers have to be hired to make plans, estimates, etc., whereas the Department, if provided with sufficient engineering assistance, could prepare a uniform set of plans and specifications for bridges and roads, and furnish them to those counties desiring them, free of charge; and, as the endurance of a roadbed depends very largely upon the qualities of the stone used, it is of the utmost importance that proper tests of material to be used, as to abrasion, crushing, cementation, etc., be made before work is commenced, and advice given as to the best manner in which to lay the same.

Counties could, in this manner, furnish the Department with samples of all deposits existing within their limits which might be considered useful as road-building materials, and they could be properly classified and designated as to their value in this respect. The matter of tests of road material has received a great deal of attention from the Massachusetts and New York Highway Commissions, as well as from the Maryland Geological Survey, and it has been found a most important factor in determining the actual wear-resisting qualities of various rocks. The Department is at present furnished with a first-class cement-testing machine, and it is hoped that it will soon be able to add other laboratory apparatus in the way of microscopic, photographic, and analyzing instruments, rock-testing machines, etc.

MACHINERY TO BE LOANED TO COUNTIES.

Your Commissioner has already expressed his desire that a number of modern road machines, such as graders, scrapers, rollers, rock-crushers, etc., be purchased by the State, and loaned upon requisition to such counties as are financially unable to furnish themselves with such machinery.

POWERS OF COMMISSIONER REGARDING STATE ROADS.

While the Supervisors of a county have power to prosecute actions for the condemnation of property for county road purposes, and to appear as parties plaintiff to actions against destroyers of county highways or structures, no provision is made in this respect in regard to our State roads and structures, which are not under the control of the county.

It is therefore recommended that authority be vested in the Highway Commissioner to bring action, in the name of the State, in the State or Federal courts, for the purpose of condemnation of property for road purposes, under the right of eminent domain, and that he be empowered to regulate the traffic over State highways and bridges, with power to prosecute offenders.

The importance of vesting the authority of condemnation in a proper party can be realized from the fact that at the present time the right of way for the extension of the Tioga State Road through the Yosemite National Park has been denied by the Secretary of the Interior, and, as it has been decided by the Attorney-General of this State that, inasmuch as no special power is vested in the Highway Commissioner or other State official to commence proper condemnation proceedings, work has, of necessity, been delayed on this important State road, and though available funds are at hand for its construction, and all preliminary work as to surveying, etc., been completed, and contracts ready to be let for actual construction work, the matter will have to rest as it is until such time as the right of way can be secured.

As has been mentioned previously, the State has just completed the building of an excellent stone bridge across the North Fork of the American River, on the Lake Tahoe Wagon Road, and has placed stone milestones along that highway; some road machinery and tools are also owned by the State; and in case such structures, machinery, or tools should suffer destruction at the hands of mischievously inclined persons, or encroachments be made on the State's right of way, it might be a hard matter to decide legally as to who should prosecute the action in the name of the people; and, as a safeguard, and in order the more thoroughly to protect such property, it is recommended that the Commissioner of the Department of Highways be empowered to prosecute all such actions, and to offer suitable rewards, with the approval of the Governor, for the conviction of parties defacing or in any way destroying the road property of the State.

AMENDMENTS TO BONDING LAWS.

It is further recommended that the bonding laws be so amended as to enable incorporated cities to coöperate with the country in the issuance of bonds for road construction.

The Legislature of 1897 passed a bill providing for the construction of an improved highway between Sacramento and Folsom, the State to furnish the material for macadamizing from the Folsom State Prison quarries, while the County of Sacramento was to furnish money for grading, labor, freight charges from Folsom, and work of actual construction, the State thereafter to assume the cost of the maintenance and care of the road.

Inasmuch as no county funds for such a purpose were available in Sacramento County, an election was called by the Supervisors, and 4 per cent bonds, to the amount of $75,000, were voted for, the City of Sacramento voting almost unanimously for the bonds, while the outside precincts carried by over two-thirds majority. However, the proposed sale and issuance of bonds was held to be illegal by the Supreme Court of the State, as it was decided that incorporated cities cannot be

taxed for road purposes in the absence of statutory authorization, and that the authority of the Board of Supervisors to expend funds of the county in constructing county roads is limited to localities outside of incorporated cities, and no tax can be levied by them for county road purposes upon any property within an incorporated city. (*Devine* vs. *Board of Supervisors of Sacramento County et al.*, 121 Cal., p. 670.)

Therefore, only a few of our smaller and more sparsely settled counties can be bonded for road purposes under the present law, and in these counties the issuance of bonds is impracticable; and, until such amendments to the law are made as will enable incorporated cities to be taxed in this manner, no help can be looked for in this direction, which has proved of great advantage in other States.

The readiness of the city to join with the county in road construction was set forth in the returns of the Sacramento County bond election, when the city carried by over 91 per cent, as against a 74 per cent vote of the country.

STATE ROAD MAPS.

It is the desire of the Department to compile sectional road maps, each section to cover certain portions of the State, in order that the public may be given the benefit of a reliable system of State road maps, which is not in existence at the present time. No appropriation has heretofore been made for this purpose, but the expense of such compilation, together with the necessary drafting work, publishing, etc., could be well carried out by the creation of a "revolving" fund, the proceeds from the sale of the maps to the public returning to the fund, allowing the work of compilation and publication to proceed without expense to the State. The demand for such a system of road maps is universal throughout the State, and certainly justifies the creation of a fund along the lines suggested.

NECESSITY FOR STATE AID.

BAKERSFIELD-SANTA BARBARA ROAD.

The importance of a highway, serving as a direct outlet to the coast from that portion of the San Joaquin Valley embraced in Kern County, can be best appreciated by an examination of the present existing conditions.

Bakersfield, as the center of the great oil-fields of the State, as a railroad town, and as the principal city of an important farming and stock-raising community, demands such an outlet to the sea. The nearest existing road from this city over the Coast Range to the north is from Stanislaus into San Benito County, a distance of about 250 miles, and that to the south is from Ventura County into Los Angeles County. It will thus be seen that the great San Joaquin Valley has practically no interior outlet throughout its entire length.

In 1899, it was pointed out to the Department of Highways that a

road leading directly from Kern into Santa Barbara County, along the proposed Bakersfield-Santa Barbara route, would be not only centrally situated geographically, but would meet the demands of the most thickly settled communities in the interior of the valley. Accordingly, an examination of the proposed route was made in the spring of 1900, and another in the fall of the same year. It was found that the construction of the road in view is entirely feasible, being susceptible of good location as to grade, and passing through a country well watered by mountain streams. Such a road would be but 80 miles in length, and could be traveled by heavy wagons in two days; whereas, at present, the ocean cannot be reached by wagon-road except through Pacheco Pass, in Stanislaus and San Benito counties on the north, and through Ventura County to the south. By the construction of such a road, not only would the people of the counties of Kern and Santa Barbara be benefited, but the valley counties of Tulare, Fresno, Kings and others, would be given the advantage of easy access to the coast, and travel to the valley from the coast counties of Santa Barbara, San Luis Obispo, and Ventura would be facilitated. It will thus be seen that such a road is by no means local in its importance. It would form a natural geographical and commercial outlet from the great interior valley of California to the sea, and would benefit a large portion of the State.

TEJON PASS ROAD.

The Tejon Pass forms the only traveled highway at present between Southern California and that portion of the State to the north, with the exception of the coast road, and though geographically the most feasibly situated outlet, the sparseness of population and the poor section of country which it crosses have made it impracticable for this road to be kept in a fit condition to travel. This road, leading from Los Angeles County into Kern County, forms the connecting link between Southern California and the San Joaquin Valley, joining together two rich and fertile portions of the State, and should be supported by the State at large.

SACRAMENTO-YOLO ROAD.

During the heavy floods of winter, which overflow the flat and low-lying lands at the junction of the Sacramento and San Joaquin valleys, communication between these two valleys by a direct route is at present impossible, and, though the northern counties demand the construction of a direct road, it has been found financially impossible for the county of Yolo individually to build a road and keep it open during the winter storms. The maintenance of about 10 miles of such a road, lying between Sacramento and Yolo, should be assumed by the State.

HUMBOLDT-SHASTA COUNTY ROAD.

A glance at a map of California will show the relative position of the counties of Humboldt and Shasta; the county of Trinity, with a popu-

lation of but 4,383, lying between. The most expensive portion of a road passing directly from one of the first-named counties to the other would necessarily have to traverse Trinity County, which is unable to bear the burden of such expense, and thus it is that the traveler has the choice of two roundabout routes. Traveling from Eureka, the nearest road to the south is in the vicinity of Clear Lake, in Lake County, and, to the north, through Grant's Pass, in Oregon, leaving a stretch of about 250 miles between these two points without an opening either east or west. The construction of about 40 or 50 miles of road, completing the chain from Redding, through Weaverville to Eureka, should be borne by the State; otherwise, the mountain range between the coast and Trinity County is likely to remain untraversed by a road for years to come.

TALLAC–M'KINNEY'S.

The construction of a road between Tallac and McKinney's, as forming part of the Lake Tahoe State Wagon Road system, properly comes under the jurisdiction of the State. There is a road in existence at present from the Lake Tahoe State Wagon Road to a point about 2 miles north of Tallac, which is situated at the south end of Lake Tahoe. There is also a road coming from the north, running to McKinney's, which is on the north end of the Lake; but the chain is there broken, for lack of a connecting link of about 8 miles. In order to reach McKinney's from Tallac at present by team, it is necessary for one to travel back to Placerville, thence to Auburn, up through Colfax, Dutch Flat, Emigrant Gap, etc., to Tahoe City, and thence to McKinney's, reversing the process for travel from McKinney's to Tallac; or the traveler has his choice of going by way of Nevada, over a route almost as long. To one having horses and wagon, the steamer rates are prohibitory. The construction by the State of these 8 miles of road is recommended, and also the improvement of about 35 miles of road between Tahoe City and the present State Wagon Road.

NATIONAL PARKS TO BE OPENED UP.

The Mount Whitney and Kings River country, in which lie the Sequoia and General Grant National Parks, is practically unknown to the average resident of the State, and much more so to the tourist in California. The Giant Forest, situated in the Sequoia National Park, contains thousands of trees towering more than 300 feet above the ground, at an altitude of about 7,000 feet; the Kings River, the Kaweah River, and the Kern River cañons diverge into this country, all of them containing scenic beauties not excelled by the Yosemite. It is recommended that the coöperation of the Federal Government be solicited, looking to obtaining some assistance in the way of making these national reservations of more benefit to the public.

APPENDIX A.

REPORT OF THE COMMISSION ON ROADS IN YOSEMITE NATIONAL PARK, CALIFORNIA.

United States Engineer Office, Pacific Division,
San Francisco, Cal., December 4, 1899.

Sir: The Yosemite National Park Commission, constituted by paragraph 28, Special Orders No. 100, Headquarters of the Army, Adjutant-General's Office, Washington, April 29, 1899, * * * has the honor to submit the following report:

The Commission assembled at San Francisco, Cal., on May 27, 1899, and organized. After a general discussion of the duties with which the Commission is charged by the terms of the Act, and of the means and method of their execution, it was found desirable to have possession of maps and documents bearing upon the subject of our investigation, and your instructions for our guidance. Accordingly, a letter was drafted and addressed to you under date of May 31, 1899, reporting the Commission as ready to enter upon its duties with the least practicable delay, and asking to be supplied with the desired information and instructions.

Upon the receipt of your reply thereto, the Commission proceeded to Wawona, Cal., and began the work in the field on July 11th. Just prior to this date, Mr. Price, ceasing to be a member of the Department of Highways of the State of California, retired from the Commission as a member, and was succeeded by Mr. Joseph L. Maude, under appointment of the Honorable Secretary of War.

Captain Harry C. Benson, having been designated by the Honorable Secretary of War to act as a special disbursing officer for the Commission, preceded the other members to Wawona, in order to arrange equipment and means of transportation supplied to the Commission by the Quartermaster's Department of the Army, and to organize the expedition.

Leaving Wawona on the 13th of July, the Commission proceeded with its wagons and pack train over the Wawona Road to the Yosemite Valley, thence over the Big Oak Flat Road to Hodgden's, thence to and over the Tioga Road to the Tuolumne Meadows at the junction of the Dana and Lyell forks of the Tuolumne River. Much delay was encountered on the Tioga Road due to fallen trees, which had to be removed; broken

bridges, and burned and rotted-out culverts, which had to be repaired, and to washouts, which required filling. Just beyond the last-mentioned point a slide in the mountain side prevented the further advance of the wagons without the expenditure of considerable time and labor for repair, so the Commission proceeded thence by saddle animals and pack train, over a good wagon road, as far as Tioga, the end of the old Sierra wagon road, and thence by trail to the inspection of routes leading over the summit.

The return was made over the same route as far as Crane Flat, where terminates a branch of the Coulterville Road, which took us to Hazel Green on the main Coulterville toll-road leading into the valley; this was followed to Big Meadows. Here saddle animals and pack train were taken again, and the wagons sent on to the Cascades to await our arrival there.

The Commission went over McCauley's Hill a short distance by wagon road, and thence by trail to the mouth of Crane Creek, and followed a trail along the north bank of the Merced River Cañon to the western boundary of the National Park; the return trip was made upon the south bank of the river as far as practicable, following the old Mariposa County trail, which crosses to the north side of the river near Hennessy's and continues on to the Cascades, at which place the wagons were picked up and the Commission arrived at Wawona July 27th.

Subsequently, the Commission, with saddle animals and pack train, proceeded by shortest trail to Tioga, to examine in detail the several routes connecting with roads traveled by wagon in Mono or Inyo counties. There are three possible routes across the dividing ridge of the mountains, namely, the Mill Creek, the Levining, and the Bloody Cañon, in the order named, from north to south, and all were traversed by the Commission, and incidentally a trip was made over a good trail, from the Tioga Road to the foot of the Lyell Glacier, prior to the return to Wawona September 1st.

Later, the Commission proceeded, with saddle and pack animals, to Hog Ranch, and began an examination for a wagon road into the Hetch Hetchy Valley.

The trail into Poopenant Valley was taken with the possibility of finding a suitable route for a wagon road therein along the bed of the river. Such was found impracticable, and the trail to McGill's was followed and the valley entered from the north. Two days were spent in examining possible exits from the valley, after which the return was made by direct trail to Hog Ranch and on to the Tioga Road.

The question of a wagon road through the Tenaiya Cañon, to furnish a direct route from the valley to the northeastern portion of the National Park, received attention, and although it was reported to be entirely impracticable even for a trail, nevertheless the Commission proceeded to

Lake Tenaiya, and one of its members, Mr. Maude, essayed the cañon on foot, and succeeded with great difficulty in passing through.

The Commission reached Wawona September 17th. There remaining only to consider the road entering the Park from the west, the Commission removed to Mariposa, and operated from this point in an examination of several proposed routes, especially the Merced River route. Several days were passed hereabouts on horseback, in covering trails and roads to and along the river, and points on the river were visited and examined. This completing the field work of the Commission, it returned to San Francisco and entered upon the preparation of its report. The results of all these investigations are succinctly given under separate headings.

At Wawona, Cal., September 1st, a hearing was given to a delegation of the Mariposa Board of Supervisors, presenting to the Commission certain plans and surveys of routes to the Yosemite Valley for its consideration, and at Mariposa two days were devoted to hearing the views of delegates from the Merced Board of Trade and from the Mariposa County Supervisors and from the town of Le Grand, in Merced County, and others present and interested in the matter, and an examination of the records of these surveys in the archives of the county court-house.

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THE BIG OAK FLAT TOLL-ROAD.

The western terminus of this road is somewhat indefinite, but it is near to the dividing line between Mariposa and Tuolumne counties, in Section 27, Township 1 south, Range 17 east, Mount Diablo base. It runs in a generally due easterly direction for a distance of about 9 miles, when it enters the Yosemite National Park at about midway of its western boundary, and continues on easterly to the boundary of the original Yosemite Valley grant to the State of California, at Gentry's.

According to Wheeler's survey, the length of the road within the National Park is 19.03 miles; it is, on an average, 13 feet wide, and has a maximum grade of 16 per cent. During all seasons while open to travel it is kept in good condition and repair. The road was completed in 1874 by the Yosemite Turnpike Road Company, a corporation under the laws of the State of California. It originally extended about 4.37 miles farther east, to the floor of the Valley, but this portion was purchased by the State in 1886. The ownership of the road is now vested in the Big Oak Flat and Yosemite Turnpike Road Company, a corporation created on the 3d day of June, 1879, and existing under the laws of the State of California, and holding a franchise duly granted to collect tolls on said road for fifty years from date of incorporation of the Yosemite Turnpike Road Company, January 20, 1871.

The original cost of the road is stated at approximately $40,000, to which amount should be added the subsequent betterments, such as

bridges, changes of grades, and other improvements, to make up the total cost of the road, in the estimation of its owners at the present day, $45,000. The Commission is satisfied that the amount stated was required at the time. It is a dirt road, pure and simple, from its western end to the borders of the Yosemite Valley grant at Gentry's, and, in the opinion of the Commission, could be built at the present day for about $30,000, with probably better grades and alignments.

The road begins with an elevation of about 3,000 feet above the sea-level, descends to 2,650 feet at the crossing of the South Fork of the Tuolumne River, and then ascends gradually to an elevation of 3,970 feet before reaching Hardin's (elevation, 3,550 feet), in a distance of 4.39 miles. From here the road ascends quite uniformly for a distance of about 11 miles, to the Tuolumne Big Tree Grove (elevation, 5,650 feet), passing through Crocker's (elevation, 4,452 feet), and Hodgden's (elevation, 4,673 feet). Thence the road climbs 1 mile to Crane Flat, at an elevation of 6,350 feet, and 2 miles more to the summit, 7,250 feet. From this point it descends with a uniform grade through Tamarack (6,390 feet), and Cascade Creek (6,150 feet), to the floor of the Valley at about 4,000 feet in a stretch of $10\frac{1}{4}$ miles. The average grade of the road may be fairly stated as 8 per cent, there being places where a grade as high as 16 per cent is encountered.

In estimating the cost of the construction of the road three classes of work should be considered: First, that portion where the roadway is over flat or gently sloping ground, where no particular excavation or fill is necessary, of which there are some 14 miles, would cost $500 per mile, or $7,000; second, the roadway along the hillsides, with cut and fill, approximating 15 miles in length, at $1,200 per mile, $18,000; and, third, along where rocks and bowlders have to be blasted, and retaining walls built, aggregating 1 mile, at $5,000; giving a total of $30,000 for the entire road, were it to be built to-day.

The annual cost of maintenance of this road is stated at $350. The rate of tolls are fixed annually by the County Supervisors, and the present rates of toll for travel are:

For each person, each way	$1 00
For one two-horse team, each way	3 00
For each additional animal	50
For each footman, each way	50
For loose cattle and horses, per head	10
For sheep and hogs, per head	05

The annual tolls collected for the period 1869 to 1880 appear to have been $2,567.50, and for the past five years $1,781.90.

The season open to travel, and actually traveled by the public, is from about May 15th to November 1st, depending upon the character of the seasons. The stage company runs its stages from about June 1st to August 15th, outside of which the travel is so light as not to warrant the keeping up of the stage service.

THE COULTERVILLE TOLL-ROAD.

This road begins at Bower Cave, in Mariposa County, and running in a generally easterly direction, crosses the boundary line of the Yosemite National Park about 9 miles from the initial point, passing on to the "Blacksmith Shop" as its terminal point, about 1⅛ miles west of the boundary of the Yosemite Valley grant; its total length, as defined above, is 29.04 miles. In addition thereto is a branch joining Hazel Green with Crane Flat, a station on the Big Oak Flat Road, the length of this branch line being 4.76 miles.

According to the Wheeler survey, the length of the main road within the limits of the National Park is 19.5 miles, and the branch line is wholly within the limits of the Park, 24.26 miles.

The construction of this road was begun in 1870 by the Coulterville and Yosemite Turnpike Company, a corporation organized and doing business under the laws of the State of California, and was finished in 1874. It originally was built to the floor of the valley, 4 miles beyond its present terminus, but in 1886 this portion was purchased by the State of California, under an Act of the Legislature, and made free. The ownership of the road is still with the original builders, the Coulterville and Yosemite Turnpike Company.

* * * * * * * * * * *

(The information regarding cost of construction, rates of toll, etc., is derived from a statement furnished to the Commission by its president, and appears in the original report of the Yosemite Commission, and marked as "Exhibit B.")

* * * * * * * * * * *

The cost of construction is shown to be $71,000 for the entire road from Bower Cave to the floor of the valley, including the branch line to Crane Flat. In betterments, from time to time, $14,000 has been expended, thus bringing the cost up to $85,000. Ten thousand dollars was paid by the State for the short piece of road between the "Blacksmith Shop" and the floor of the valley; so the remaining portion of the road would seem to have a value of $75,000. Considering the wage rate for labor at that time, as well as the cost of tools and excessive cost of explosives, the Commission is satisfied that the estimates given it by the company are correct. However, considering the present cost of labor and materials, it is unquestionable that the road could be constructed now for very much less money. It is estimated that a road equally as good, along practically the same route, could be constructed for about $50,000, and with this amount of money better alignments and grades might be secured than those existing on the present road.

A more detailed description of the road follows: Beginning at the initial point, Bower Cave, at an elevation of 2,500 feet above sea-level, the road crosses the western boundary of the Yosemite National Park at

an elevation of 5,150 feet at a distance of 9½ miles; thence, it continues to ascend to an elevation of 6,050 feet on the top of Sugar Pine Ridge in a distance of 5 miles, passing through Hazel Green at an elevation of 5,665 feet. From Sugar Pine Ridge a descent is made to Big Trees, elevation 5,400 feet, in a stretch of 1½ miles. To the crossing of Little Crane Creek the road continues to descend to a level of 4,600 feet in 5 miles, and ascends through 1.45 miles to the top of the divide, 4,800 feet. The descent from this point is made to Big Meadows, 2 miles distant, at an elevation of 4,350 feet. A rise is made from here to 4,650 feet in a stretch of 1 mile, and a final descent to the "Blacksmith Shop," elevation 3,500 feet in a distance of 3.59 miles.

The salient points of the profile only are given, there being, of course, many undulations in the grade. The major portion of the grade may be stated as being 8 per cent, though in some places a grade of 16 per cent is attained.

The width varies from 8 feet to 20 feet, and is sufficient for teams to pass one another, save in places where the roadway was necessarily restricted in width by reason of costly construction, and here suitable turnouts are provided.

The cost of maintenance of the road for the period from 1874 to 1880 is given as $1,000 per year; from 1880 to 1890, $750; and since then, $600.

In the construction of this road, three classes of work should properly be considered in arriving at its approximate value:

First, that where the road runs over comparatively level or gently sloping ground, and where the principal work consists in clearing the way of small and medium-sized trees, in crowning the roadbed, and ditching. Taking the main road, there are in the aggregate 7 miles of this class which could be built for $600 per mile.

Second, side-hill work, where there would be required considerable "cut and fill," timber to be cut and removed, ditches and culverts constructed. The cost of this class of work is put at $1,400 per mile, and there are about 20 miles of it in the main road.

Third, rock work. The removal of large bowlders and the construction of retaining walls characterize this class, and is estimated to cost $6,000 per mile, and there are about 2 miles of it.

The branch road is estimated to cost about $1,000 per mile.

The following is a summary:

7 miles, at $600 per mile	$4,200
20 miles, at 1,400 per mile	28,000
2 miles, at 6,000 per mile	12,000
4.76 miles, at 1,000 per mile	4,760
Total cost	$48,960

The road is kept in good condition during the season of travel, which generally is from April to November, but this period is dependent upon

the character of the season. During some winters which were milder and freer from snow than the ordinary winters in the Sierras, the road could be traveled the entire year, but such winters are exceptional.

The Board of Supervisors of Mariposa County fixes annually the rates of toll to be charged, and the rates are not materially changed from year to year. They are:

For passenger teams, per passenger	$1 00
For horse and rider	1 00
For freight teams loaded, per animal	1 00
For freight teams empty, per animal	50
For pack animals, each way	75
For animals loose, each	37½
For sheep and hogs, each	10
For bicycle and rider	50

The annual tolls collected are stated to have been to the year 1891, $2,500; from 1892 to 1898, inclusive, $1,000; or a total revenue from tolls of $33,932.71 to date.

WAWONA TOLL-ROAD.

The Wawona Road, as generally understood, has its initial point at Raymond, in Madera County, the terminus of the branch line of the Southern Pacific Railroad from Berenda to Raymond, and extends thence in a northerly direction, entering the south boundary of the Yosemite National Park at Wawona, and continues northerly to the Yosemite Valley, a total distance of 73 miles, of which length 26 miles are within the limits of the Yosemite National Park, and 7 miles lie wholly within the limits of the Yosemite National Grant. In addition to this main line of travel, a branch line from the town of Mariposa makes junction with the main line at a point about 1 mile south of Wawona. Another branch leaves the main road at Four-Mile Station, some 4 miles to the south of Wawona, and runs thence in a meandering but generally easterly direction to the State grant surrounding the Mariposa Grove of Big Trees. Another branch leaves the main road at Chinquapin Station, about midway between Wawona and Yosemite Valley, and runs in a northeasterly direction to Glacier Point, which overlooks the Yosemite Valley near its head.

Not all of the road described above is toll-road. On the main branch from Raymond to Yosemite, from a point 8 miles north of Ahwahnee, to a point on the boundary line between Madera and Mariposa counties, the road is maintained by the owner of the Miami sawmill, Dr. Cassell, of Iowa, and tolls are collected. At the boundary line begins the main toll-road, known as the Wawona toll-road, owned and controlled by the Yosemite Stage and Turnpike Company.

Starting with an elevation of 5,200 feet, the road descends in a distance of 3 miles to Summerdale at an elevation of 4,900 feet; thence to the Four-Mile Station, a distance of 3 miles, 5,000 feet is reached; then

the descent is made to 4,028 feet at Wawona, in a distance of 4 miles. Eight-Mile Station is 8 miles beyond, with an elevation of 5,520 feet, and at a farther distance of 5 miles, 6,390 feet, the highest point in the road is reached. From here the road descends to Grouse Creek, elevation 4,650, in 4 miles, and then ascends to Fort Munroe, with an elevation of 5,330 feet, in a stretch of 2 miles, and here entering the boundary of the Yosemite Valley grant drops to the floor of the valley. The portion, however, from Fort Munroe to the floor of the valley was purchased by the State of California, and is now a free road.

Ownership is vested in the Yosemite Stage and Turnpike Company, a corporation existing under the laws of the State of California, who, at our request, submitted a detailed report (original of which appears as "Exhibit C" in the Report of the Commission on Roads in Yosemite National Park), from which we extract the following data: The cost of maintenance of that portion of the road from Madera County line to the valley, for a period of seventeen years, has averaged $2,465.20 per annum. The cost of construction was $52,000, which, considering the conditions prevailing at the time, was exceedingly reasonable. The company is unable to segregate the amount of tolls collected from each branch, so this matter will best be presented later on. The tolls collected are annually fixed by the Board of Supervisors of Mariposa County, and are at the present time as follows:

South Fork and Yosemite Road.

For horse and buggy, or other vehicle, each horse	$1 00
For freight teams loaded, per animal	1 00
For freight teams empty, per animal	50
For horses and mules and rider	1 00
For animals packed, each	75
For animals loose, each	25
For sheep and hogs, each	10

Road from Wawona to Boundary Line Between Mariposa and Madera Counties.

For horse and buggy, or other vehicle, each horse	$1 00
For freight teams loaded, per animal	1 00
For freight teams empty, per animal	50
For animals packed, each	50
For horses, mules, or oxen, each, loose	25
For sheep and hogs, each	10
For horse and rider	50

Bridge South Fork of the Merced River, near Wawona.

For horse and rider	$0 25
For animals loose, each	05
For animals packed, each	10
For sheep, hogs, and goats, per 100	75
For horse and buggy, each horse	25

The company maintains this road open to travel from April to December, and some years during the entire winter, depending on the character of the season.

The road construction purposes may be divided into three classes: Sidehill work, with "cuts and fills," as general characteristics of the road, and a much heavier class of side-hill work, involving heavy "cuts and fills," with high retaining walls, and the removal of rocks and trees. The first class would cost $1,200 per mile, there being about 20 miles of this class of work. Of the second class, $2,000 per mile would be necessary for construction; of this class there are 8 miles. While for the third class, rock work with heavy retaining walls, the aggregate length would be about 1 mile, and would cost $5,000, making the total cost for the road $46,000, the grade varying from zero to 10 per cent; in some few places for short distances, 12 per cent; by far the major portion of the grade approximating 6 per cent. The width varies from 8 to 20 feet, and there are but few places where teams cannot pass, and those for only short distances of 100 to 200 feet. Its present condition, for a mountain road, carrying such heavy traffic, is very good.

MARIPOSA BRANCH.

The portion of this road upon which tolls are collected begins at a point 2½ miles east of White & Hatch's sawmill, and covers the road to a junction with the main line at a point about 1 mile south of Wawona. The initial point has an elevation of 3,500 feet, and the road rises to the summit of the Cowchilla Mountains, an elevation of 5,800 feet, in 6 miles, descending from there to the junction with the main line, at an elevation of 4,450 feet. The grades vary from zero to 14 per cent. The width of this road permits the passing of teams at all points, and will readily average 16 feet. The ownership is vested in the Yosemite Stage and Turnpike Company, who maintain the road in fair condition. Their report of the cost of maintenance, covering a period of seventeen years, gives an average of $681.50 per annum. They also report its cost at $15,500, which seems to us a reasonable estimate, but we think that $14,000 would construct this road at the present day, and, possibly, with the same amount of money, better grades could be obtained. The tolls collected cannot be segregated for this branch. The rates of toll, as allowed by the Board of Supervisors, are as follows:

Road from White & Hatch's to Wawona.

For horse and buggy, or wagon	$1 00
For two horses and buggy, or wagon	2 00
For each additional animal in teams of all kinds	1 00
For freight teams empty, per horse	50
For ox teams	The same as horse teams.
For saddle animal, with rider	50
For animals packed, each	25
For loose horses, mules, or cattle, each	20
For hogs, sheep, and goats, each	05

This road is open to the public from April 1st to December 1st, or longer, the length of time dependent on the character of the season.

CHINQUAPIN BRANCH.

This branch extends from Chinquapin Flat to Glacier Point.

Beginning at Chinquapin, at an elevation of 6,250 feet, ascent is made to the divide, at an elevation of 7,650 feet, in a distance of 4 miles. Thence it descends to 7,000 feet at the crossing of Bridal Veil Creek, which is reached in a distance of 2 miles. Ascending again, the road reaches an elevation of 7,900 feet, near Ostrander Rock, where it crosses the boundary line of the Yosemite Valley grant. Continuing on practically this level, the road passes to the southeast of Sentinel Dome, at an elevation of 7,800 feet, and from there descends to an elevation of 7,300 feet at Glacier Point, a distance of 4 miles from Ostrander Rock, the total length of the road being 14 miles, of which amount 4 miles is within the boundary of the Yosemite Valley grant. The grades on this road vary from zero to 14 per cent, and the width is sufficient at all places for teams to readily pass one another. The ownership of the road is vested in the Yosemite Stage and Turnpike Company, who maintain the road in good condition. The cost of maintenance of this road averages about $850 a year. The cost of construction, as shown by the company's report, was $8,000, an exceedingly reasonable cost, and we are satisfied that the road could not be constructed at the present time for a less sum of money. The amount of tolls collected on this branch has not been segregated by the company in its report. The rates of toll, as allowed by the Board of Supervisors of Mariposa County, are as follows:

Road from Chinquapin to Yosemite Grant, Near Glacier Point.

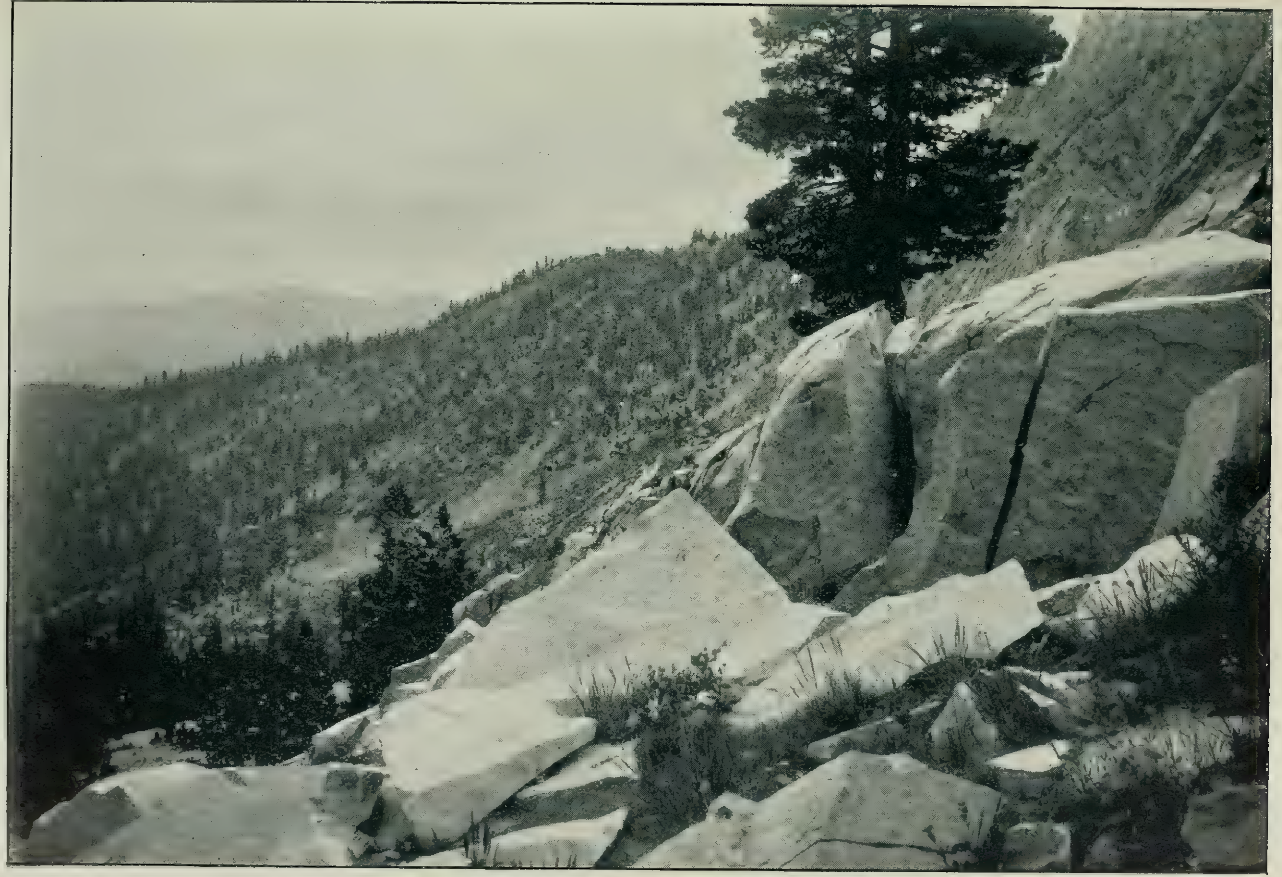
For freight teams, per horse, loaded	$0 25
For freight teams, per horse, empty	12½
For horse and buggy, or other vehicle, per horse	25
For horse and rider	12½
For loose horses, mules, and cattle, each	05
For sheep, goats, and hogs, each	02

This road is open for travel from the 15th of June to the 1st of November.

THE BIG TREE BRANCH

Is a road branching from the main line between Raymond and Wawona, and giving access to the Mariposa Big Tree Grove. Leaving the main road at Four-Mile Station, at an elevation of 5,000 feet, the road extends thence in a general easterly direction, but is exceedingly meandering in character, and crosses the boundary line of the Mariposa Big Tree Grove at an elevation of 5,600 feet, at a distance of 2 miles, the grades varying from zero to 10 per cent. The width is sufficient at all times for teams to pass. The ownership is vested in the Yosemite Stage and Turnpike Company, who maintain it in good condition. The cost of maintenance of this branch is included in that of the main road. The statement shows the cost of construction to have been $1,250, a very reasonable

Mono Pass—Mount Gibbs on Right, Mount Parker on Left—Indian Wickiups in Foreground.



Spur of Mount Parker, Line of Extension of Tioga Road.

Outlet of Sardine Lake. Elevation, 9,883 Feet. Line of Extension of Tioga Road.

Above Sardine Lake, Looking East. Elevation, 10,510 Feet. Line of Extension of Tioga Road.

Mount Parker (West Side), as Seen from Extension of Tioga Road.

amount, and one which would be necessary at the present time to duplicate the road. The tolls collected have not been segregated in this instance by the company, but the rates, as allowed by the Board of Supervisors, are as follows:

From Wawona to Big Tree Grant Line.

For freight teams loaded, per animal	$0 50
For freight teams empty, per animal	25
For horse and buggy, or other vehicle, per horse	50
For animals packed, each	25
For horses, mules, or oxen, loose, each	12½
For sheep and hogs, each	05
For horse and rider	25

This road is open for travel from April to December.

Summarizing the roads owned and controlled by the Yosemite Stage and Turnpike Company would give the following:

1. Cost of construction of roads	$76,750 00
2. Cost of maintenance of roads, 17 years	65,636 78

Cost of construction includes the bridge spanning the South Fork of the Merced River at Wawona, and is for a total mileage of between 59 and 60 miles. We believe that these roads can be built at the present day for $70,750. The tolls collected over the entire system of roads owned by the company appear to have been $221,254.11 for a period of seventeen years, from 1882 to 1898, inclusive. Had an accurate account been kept previous to 1882, this amount would have been increased from 15 to 20 per cent, as shown by the statement of the company.

TIOGA ROAD.

The proper name for this road is "The Great Sierra Wagon Road." The initial point is in Section 34, T. 1 S., R. 19 E., near Sequoia Post-office, and, keeping in this tier of townships, the road runs in a general easterly direction until it reaches the eastern boundary of the Yosemite National Park, near the northern part of T. 1 S., R. 25 E. Outside the boundary it turns and continues due north for a distance of 6 miles to the Tioga mines. Its length is 56.15 miles, about 51 miles of which are within the limits of the Yosemite National Park.

With the initial point 4,450 feet above the sea-level, the road descends through 2.2 miles to the South Fork of the Tuolumne River, at 4,160 feet, then ascends with an easy grade to 6,380 feet at Aspen Valley, in a distance of 8.36 miles; continuing to ascend, the lower crossing of the Middle Fork of the Tuolumne River, with an elevation of 7,000 feet, is reached in 4.3 miles; and White Wolf, 8,090 feet, in a farther distance of 5.62 miles; and the summit, 8,550 feet high, 2.56 miles beyond. From here is a gradual descent to the crossing of Yosemite Creek, 7,200 feet, in 3.85 miles, when the road again ascends, passing through Porcupine Flat, 8,000 feet, distant 3.84 miles; thence through 5.19 miles to

Snow Creek Divide, elevation of 8,700 feet. From here to Lake Tenaiya the grade is a descending one, the elevation of the lake being 8,146 feet, and the distance 2.81 miles. From this point the grade ascends to the summit, with an elevation of 8,690 feet, in a distance of 2.95 miles. It then descends to the Tuolumne Meadows, with an elevation of 8,550 feet, in a distance of 5.38 miles. Beyond, the ascent is gradual until the summit of McLean's Pass is reached, with an elevation of 9,941 feet, in a distance of 7.03 miles. From McLean's Pass to the terminal point, Tioga, with an elevation of 9,795 feet, is 2.06 miles. (A profile of the road accompanies the original report.)

There is no uniform grade to this road, it varying from zero to 10 per cent. The road, however, was skillfully laid out, and it may safely be said that most of it has a grade of only 3 per cent. The width varies from 10 to 20 feet, the greater portion being about 14 feet, and there can be no difficulty in teams passing one another at almost any point, but at the narrower points along the road suitable turnouts are provided.

The present owner of the road is Captain Rudolphus N. Swift, Acushnet, Mass., and he has furnished us a report showing titles, cost of construction, rates of toll, etc., * * * from which it appears that the original cost of construction was $62,000. The Great Sierra Consolidated Silver Company was the original constructor of this road, and it was exceedingly well built, the bridges having fine stone abutments, and there is a particularly well-built section of sea-wall along the shore of Lake Tenaiya. Retaining walls were located wherever there was the least necessity for them, and all are well constructed. The surfacing of the road was originally good, but now practically all gone, and many of the timbers in the bridges are rotten. The Commission, on its tour of inspection over the road, was obliged to make repairs, and to replace rotten timbers before passage could be made over the bridges. The retaining walls in a few places have given way, and the surface of the roadbed has been badly washed, heavy gullies having been cut in places. Where the road has passed over rock all of the earth surfacing has been washed away. This is particularly noticeable in the descent to and ascent from Yosemite Creek, and in the descent to Lake Tenaiya. The road was also obstructed by fallen timber, which, in some instances, measured 6 feet in diameter.

It appears that no road work in the way of maintenance has been done by the owner of the road for a number of years, though some slight work has been done by campers traveling over it. The cost of construction of a like road at the present time may be summarized as follows: Of flat and slightly sloping ground there are 20 miles, which would average in cost $400 per mile. Of hillside rock, requiring cuts and fills, the removal of timber and small rocks, there are 33 miles, which would cost $1,200 per mile. Of rock work, the construction of retaining walls, and heavier cuts and fills, there are 2 miles, which

Sardine Lake and Mount Parker, from Mount Gibbs, on Line of Extension of Tioga Road.

Extension of Tioga Road Survey.

would cost $2,500 per mile, and of sea-wall around Lake Tenaiya there are 1.15 miles, which would cost $5,000 per mile, giving a total of $58,000 for the road.

It appears that in the early history of the road some tolls were collected. None, however, have been collected for a number of years past. The rates of toll are fixed by order of the Boards of Supervisors of Mariposa and Tuolumne counties, and are as follows:

From Crocker's Station, in Tuolumne County, to Tioga, in Mono County, a Distance of 56.15 Miles.

For freight team with two horses	$5 00
Each additional horse	1 50
Empty wagons, half rates.	
Passenger teams, each horse	2 50
Footmen	1 00
Horse and rider	2 00
Each pack animal	1 50
Loose horses and cattle	50
Sheep, hogs, and goats, each	10

And for a less distance than the whole thereof in such proportions of the whole amount of tolls allowed to be charged as the distance traveled bears to the whole distance of the road.

No attempt has been made to keep the road in order and suitable for travel since the closing of the Tioga Mine, in 1885. Were there an extension of this road to points of settlement to the east of Tioga, thus making the road a thoroughfare, the road would doubtless have been maintained open from June 15th to November 1st during ordinary seasons.

Under the provisions of the act looking to a new wagon road connecting this road with a road traveled by wagon in Mono or Inyo counties, your Commission inspected three possible routes, namely, the Mill Creek, the Levining Creek, and the Bloody Cañon, these being the only practicable routes, and they are presented in detail, as follows:

MILL CREEK CAÑON ROUTE

May be best divided into five sections, as follows:

Section 1, from the Tioga Road to Saddle Bag Lake.

Section 2, Saddle Bag Lake to head of Mill Creek Cañon.

Section 3, head of Mill Creek Cañon to beginning of Slide.

Section 4, Slide to foot of cañon.

Section 5, foot of cañon to road connection in Mono County.

Section 1 leaves the Tioga Road about a mile north of Tioga at an elevation of 9,900 feet, and ascends to an elevation of 10,300 feet. The country is rolling close to the foot of the mountains. The soil is of a micaceous granitic character, and exceedingly susceptible to wash. Somewhat expensive ditching for drainage of storm-waters would therefore be necessary to protect the roadway. The section would be about

2 miles in length, with an average grade of 6 per cent, varying from 2 to 8 per cent, and costing $1,500 per mile, or $3,000 for the section.

Section 2 ascends from 10,000 feet to 10,700 feet, passing around the eastern shore of Saddle Bag Lake and over the side of Mount Warren, the formation consisting of a soapy, slaty shingle, broken in flat pieces, and varying from the size of a saucer to three or four times that size, and of an inch in thickness. The side of the mountain standing at an angle of 45 degrees, the entire roadway would be of sidehill character, and would have to be supported by a retaining wall on the lower side, and likewise protected by a retaining wall on the upper side, supporting an enormous surcharged mass of this material. Without these walls it would be impossible to construct or maintain this section. The length of the section would be 4 miles. No average grade could well be established, the grades varying from zero to 10 per cent. The cost per mile would be at least $5,000, thus giving a total cost to the section of $20,000.

Section 3 is the most expensive portion of work on the entire route. Descending from an elevation of 10,500 feet to 9,700 feet, and passing for its entire length over solid rock, with an angle of at least 85 degrees, almost the entire length would have to be in gallery. The rock is of an igneous character and of exceedingly fine texture and tough, presenting great resistance to the action of explosives. The length of the section would be 1.5 miles, and an average grade of 10 per cent could be maintained over the entire distance, and the cost of construction would be at least $15,000 per mile, or $22,500.

Section 4 descends from 9,700 feet to 8,600 feet over a loose sliding shingle of even a worse character than that at Saddle Bag Lake, standing, as it does, at an angle of 60 degrees, which is barely more than the angle of repose, thus necessitating higher and more expensive retaining walls than those of that section. The length would be 2 miles, and the cost per mile $7,000, cost of the section being $14,000.

Section 5 descends from 8,600 feet to 8,000 feet over the floor of Mill Creek Cañon, which is rough and covered with large bowlders and dense brush and small trees. While not difficult of construction from an engineering standpoint, the work will be necessarily expensive. The length is 3 miles, and the cost per mile would be $1,500, the total cost of the section being $4,500, thus giving a total length to this route of 12.5 miles, and a total cost of $64,000.

It would also seem from personal observation, as well as from information gleaned from residents, that the snowfall in this cañon is of exceeding depth, and that, owing to its conformation, the action of the sun in melting the snow is much retarded, the result being that a road through this cañon would be closed to travel for a much longer period than those through either Levining or Bloody cañons; another disad-

Looking Down Levining Creek Cañon. Suggested as a Possible Route for Extension of Tioga Road.

vantage being that this route would be fully 10 miles longer from the eastern to the western side of the mountains than either of the other named routes.

LEVINING CREEK ROUTE.

This route may be divided into three sections, as follows:

Section 1, from a point on the Tioga Road, about 2 miles south of Tioga, to a small lake at the head of Levining Cañon.

Section 2, from the lake to the floor of Levining Cañon.

Section 3, from end of Section 2, along floor of cañon to road connection in Mono County.

The sections, in detail, are as follows:

Section 1 descends from an elevation of 10,000 feet to 9,500 feet, passing over earth with a few bowlders. Some small trees and underbrush would have to be removed. The length of the section would be about 2.25 miles, the average grade would be about 4.2 per cent, and in no case need the maximum grade exceed 5 per cent. The cost per mile for the section would be $600, giving a total cost for the section of $1,350.

Section 2, descending from 9,500 feet to 7,500 feet, and passing over talus and rock in place. The rock being of granitic formation, is easily worked by the use of modern explosives. But little drilling will be necessary to make the explosives effective. The rock shatters easily, and can in almost all cases be used for filling and "chinking" within a few feet of the point of removal. On account of the elevation to be overcome, it has seemed wise to reduce the grade by lengthening the section by means of "switchbacks"; this, therefore, makes the section 4.76 miles in length, and gives a grade of 8 per cent, which can be kept uniform throughout the length of the section. All things considered, this has seemed the economic grade to adopt for this section, for, while a less grade might be established, to do so would, perforce, lengthen the section and, in a like ratio, increase the cost of construction, with comparatively little benefit to travel. While to increase the grade would have decreased the mileage, and also the cost, it was not deemed wise, as a grade above 8 per cent is burdensome to travel. The width for the roadbed for the section should be 10 feet. This would accommodate all the travel on the road for years to come. The cost per mile for the section would be $5,000, thus giving for the section a total cost of $23,800.

Section 3 descends from an elevation of 7,500 feet to 7,200 feet, and follows along the floor of Levining Creek Cañon, the soil consisting of mold mixed with disintegrated granite. There are no difficulties to be encountered in the construction of this section, the principal work consisting in the clearing away of small aspen trees and underbrush, which could be used for mattress at one or two boggy places, which would have to be drained by short ditches emptying into Levining Creek. The length of the section would be about 3 miles, and the grade would aver-

age 2 per cent and vary from 1 to 4 per cent in places. The cost of construction is placed at $500 per mile, which gives a total cost for the section of $1,500.

This would give a total length to the road of 10.01 miles, and a total cost of $26,650, exclusive of engineering superintendence.

There are many points in favor of the Levining Creek route, notably, it is but 10,000 feet in elevation at its highest point, as against an elevation of 10,600 feet at Mono Pass on the Bloody Cañon route, and 10,700 feet between the Saddle Bag Lake and the head of Mill Creek Cañon, reached in the last-named route. This route also presents the least engineering difficulties, and here a roadway can be constructed for a less amount of money than by way of either of the other routes. It is the middle route between Mill Creek on the north and Bloody Cañon on the south. It also gives a much shorter line of communication between the Mono Lake Basin and its tributary territory on the east and the Great Central Valley of California on the west than the Mill Creek route, and fully as short as the Bloody Cañon route. It can also be kept free from snow for a longer portion of the year than either of the other routes.

BLOODY CANON ROUTE.

This route would best be divided into five sections, to wit:

Section 1, from the junction of the Lyell and Dana forks of the Tuolumne River to the crossing of the Dana Fork.

Section 2, from the crossing of Dana Fork to the head of Mono Pass.

Section 3, from the head of Mono Pass through the gorge of Bloody Cañon to the foot of the same.

Section 4, from foot of Bloody Cañon gorge, along Saddle to floor of Bloody Cañon, near Walker Lake and boundary of Yosemite National Park.

Section 5, along the floor of Bloody Cañon to road connection in Mono County near Farrington's.

Section 1 ascends from an elevation of 8,594 feet at the initial point to 9,800 feet at the head of Mono Pass. The general character of the country is meadow land, interspersed with bowlders and trees, there being but little brush; the distance being 6 miles; the grade averaging 4 per cent, and varying from 1 to 6 per cent. The cost of construction would be $800 a mile, giving a total cost of $4,800 for the section.

Section 2 is of the same general character of soil as Section 1. There are, however, less trees and more rock. The roadway here ascends from 9,800 to 10,600 feet, the section being 3 miles in length. The grade would average 5.5 per cent, and vary from 2 to 8 per cent, the cost of construction being $1,000 a mile, a total for the section of $3,000.

Section 3 presents the greatest engineering difficulties, and is the most expensive of the route, descending from an elevation of 10,600 feet

Foot of Bloody Cañon, at Head of Walker Lake.

to 9,000 feet, and passing over and around bluffs precipitous in character and of a granitic character, bordering in places to trap and porphyry. The use of considerable quantities of explosives would be necessary; the rock is, however, of a character not unusually difficult to work. The lower portion of the roadway passes over talus that could be broken by hammer and moved by crowbars. The length of the section would be about 3.02 miles, and the most feasible grade would seem to be 10 per cent, which could be kept uniform for the entire distance. There should be turnouts at every thousand feet, and by their use the width of the roadway could be kept down to 10 feet. The cost would be $7,000 a mile, or $21,140 for the section.

Section 4 descends from an elevation of 9,000 feet to 7,900 feet, carries the roadway along the hillside and through earth, with but few loose rocks and small timber in the way. The length of the section would be 3.5 miles, with an average and uniform grade of 6 per cent, the cost of construction being $1,500 per mile, or $5,250 for the section.

Section 5 runs along the floor of the cañon, descending from 7,900 feet to 7,400 feet, the entire distance being over good earth, with some underbrush to remove. The section would be 2 miles long, and have an average grade of 5 per cent, the cost of construction being $500 per mile, or $1,000 for the section.

This would give a total length for the route of 17.7 miles, and a total cost of $35,190.

WAGON ROAD TO HETCH HETCHY VALLEY.

Leaving the Big Oak Flat Road at Hodgden's, a park road was followed to the South Fork of the Tuolumne River. Here junction is made with the Tioga Road, which we traveled to the top of a hill, a distance of 1.25 miles; thence by a private road through Carlin's ranch to the middle fork of the Tuolumne River, and thence over a park road to the Hog Ranch. This distance, by already existing road, is 7.18 miles, as just described. From this point on to the Hetch Hetchy no road exists, and a location for a proposed roadway was viewed.

It can best be divided into three sections, as follows:

Section 1, from the Hog Ranch to a point a mile north of the cañon.

Section 2, from end of Section 1 to a flat 600 feet above the southwest corner of Hetch Hetchy Valley.

Section 3, from end of Section 2 to floor of Hetch Hetchy Valley.

The sections in detail are as follows:

Section 1. Leaving the Hog Ranch at an altitude of 4,736 feet, the roadway gradually ascends to an elevation of 5,500 feet at the end of the section, the roadway traveling a somewhat rolling country, with but little rock and some trees of small size, the section being entirely in earth. The distance is 6 miles, and would give a grade varying from

1 to 5 per cent, and can be constructed for $1,200 per mile, or $7,200 for the section. This would include the cost of drainage and culverts.

Section 2 descends from 5,500 feet to 4,100 feet, a distance of 1,400 feet in elevation. The major portion of the way is over solid rock of a granitic character, which is somewhat decomposed and easy to work. Portions of the roadway would be along the face of bluffs standing at angles of from 45 to 80 degrees, while at other places long benches exist which could be utilized in the final location. There would be many heavy cuts, and in other places fills with retaining walls would be necessary. The length of the section would be about 6 miles. No uniform grade could be established, but in no case would it be necessary to have a grade in excess of 10 per cent, though in order to accomplish this many switchbacks would have to be made use of. The cost per mile for labor and tools, materials and explosives, in this section would average $6,000, or $36,000 for the section.

Section 3 descends from 4,100 feet to 3,660 feet, passing over solid rock standing at an angle of 80 degrees, and detritus, requiring numerous switchbacks. The major portion of the detritus would have to be supported by a heavy retaining wall. The length being 1.5 miles, grade could be kept uniform at 5.5 per cent, the cost averaging the same as the previous section, $6,000 per mile, or $9,000 for the section.

Thus giving a total length of new road of 13.5 miles, and a total cost of $52,200.

A road into Hetch Hetchy Valley having been constructed along this route, connection could then be made with the railroad system of the State by running a road out over the northern side of the Hetch Hetchy Valley, thence to McGill's Meadows, and from there to Carters, an approximate distance of about 25 miles, which is the projected terminus of a narrow-gauge railroad now in process of construction by the West Side Flume and Lumber Company. The latter road begins at Chinese Camp, where connection is made with the Sierra Railway, which ultimately makes connection with the Southern Pacific and Santa Fé systems in the San Joaquin Valley.

TENAIYA CANON ROUTE

Can best be divided into seven sections, as follows:

Section 1, leaving the Tioga Road at the western end of Lake Tenaiya and extending to the head of the first falls on Tenaiya Creek.

Section 2, from head of falls to flat.

Section 3, through flat to head of second falls.

Section 4, falls to second flat.

Section 5, through second flat to head of Cascades.

Section 6, through Cascades to Yosemite Valley.

Section 7, from end of Section 6 to Mirror Lake.

The sections, in detail, are as follows:

Section 1. Leaving Lake Tenaiya at an elevation of 8,200 feet, and following the outlet of the lake, or Tenaiya Creek, the grade is a descending one until an elevation of 8,000 feet is reached at the head of Yale Falls. The roadway through this section would pass over a meadow with a gentle slope to the west, with enough coniferous trees of moderate size to make a pleasing shade. But few bowlders are encountered. The major portion of work on this section would be the "turnpiking" and ditching of the roadway, which could be easily done with a plow and road machine. The length of the section would be 1.75 miles. A grade could be obtained varying from zero to 3 per cent, and the cost of construction would not exceed $500 per mile for a first-class roadway of 16 feet in width, exclusive of ditches. This cost would also include culverts for drainage, which would not need to be placed at some few points, and should be made of a good vitrified pipe, and at different points vary in size from 6 to 10 inches. The cost of the section would be $1,050.

Section 2. Descending from 8,000 feet to 7,700 feet. At this place Tenaiya Creek flows over solid granite of exceeding smoothness, in fact glacially polished, and the cañon becomes a gorge, of no great depth, however. Nor is the incline of the sides so great that one cannot walk over them by the exercise of due caution, their angle probably averaging 20 to 25 degrees. The roadway at this point would be of sidehill character. The rock cut from the uphill portion could be utilized for retaining walls and fill on the lower or downhill side. These retaining walls are easy of construction, and should be made of dry rubble. On this section the roadway width should be contracted to 10 feet, with two turnouts for the section. This section, properly constructed, should not need repairs for a century. The length of the section would be 1.42 miles; this length being necessary to obtain the proper grade, the air-length line of the section being probably not over 1,000 feet. The above-mentioned length having been given to the section, the grade could be established at 8 per cent and kept uniform for the entire length of the section. The cost per mile of this section can be best summarized as follows: Blasting and moving rock from cut to fill, 80 cents per yard; building retaining wall and parapet on lower side of roadway—both wall and parapet to be of dry rubble—20 cents per linear foot, as the cut would equal the fill, and the yardage would be about 2,500 yards, or cost $2,000 per mile, and with 5,280 feet of retaining and parapet wall at $1,056 would give a cost of $3,056 per mile. If it were thought more advantageous to do so, the retaining and parapet wall could be laid in lime or cement mortar, increasing the cost from $1,000 per mile for the former and $1,250 for the latter-named material. The cost for this section may therefore be placed at $4,339.50 for dry rubble walls.

Section 3 descends from an elevation of 7,700 feet to 7,300 feet, follows over the floor of a small valley presenting no engineering features of note, the main work consisting in the removal of bowlders and trees. The length of the section would be 1.25 miles, and the grade average 5.5 per cent. The cost per mile would be $1,000, making a total cost of $1,250 for the section.

Section 4 is the one presenting the greatest difficulties, and the one that would consume the major portion of the money necessary for the construction of the road. Beginning at an elevation of 7,300 feet at the head of the falls, to the foot of the falls in a horizontal line is a little less than 1,000 feet, while the vertical drop at this point is 1,500 feet, or to an elevation of 5,800 feet. Up to this point the proposed roadway would follow the course of Tenaiya Creek. Here the creek would have to be abandoned and a tunnel run in a northeasterly direction for a distance of 600 feet; thence, bearing more to the west, a gallery would run for a distance of 800 feet, from where the roadway would be a heavy cut and fill over solid rock and talus for a distance of 1,200 feet; thence by gallery and short tunnels for a distance of 4,500 feet to the talus, from whence a distance of 5,300 feet would take the roadway to the floor of the second flat, giving a total length of 12,400 feet, or 2.34 miles. This is for an average grade of 12 per cent, which should be sustained for the entire distance. The width of roadway on this section should, of course, be minimized to save expense, but in no case should the roadway be reduced to less than 8 feet in the clear. Turnouts, etc., should also be provided at proper distances.

The cost in detail would be:

600 ft. tunnel, at $5 per yard (3.15 cubic yards per foot)	$9,450
5,300 ft. gallery, at $3 per yard (2 cubic yards per foot)	30,600
12,200 ft. sidehill, at $2 per linear foot	2,400
5,300 ft. talus, at $1 per linear foot	5,300
Total for section	$47,750

Section 5 follows the floor of the second flat from an elevation of 5,800 feet to 5,300 feet, thus descending 500 feet in a mile and a half, giving a grade of about 6 per cent. The country presenting no difficult features, other than the clearing of trees, brush, and rock, the cost would be $2,000 per mile, or $3,000 for the section.

Section 6 again comes to falls, descending from 5,300 feet to 4,800 feet. There are no engineering features to the section, though the character of the rock work would be expensive, there being many heavy cuts and fills in the section. The length would be about 1.25 miles, the grade varying from 6 per cent to 10 per cent; the cost per mile would be $7,500, or $9,375 for the section.

Section 7 descends from 4,800 feet to 4,100 feet at Mirror Lake, in the Yosemite Valley. The upper two thirds of the distance is over rough

talus, with a heavy growth of brush, the length being about 4 miles, the grade varying from 2 per cent to 8 per cent, the average cost per mile being $4,000, or $16,000 for the section.

Giving a total cost of $82,764 and a length of 14.51 miles for the entire road.

NEW WAGON ROAD FROM YOSEMITE VALLEY TO SUITABLE POINTS IN MERCED, MARIPOSA, AND TUOLUMNE COUNTIES.

We present for consideration a road along the Merced River as fulfilling the conditions of a best attainable new route from the Yosemite Valley to the several points mentioned. Such a road would afford the most direct and easy connection with Merced County at Merced Falls, and at Benton Mills on the river connection would be established with the existing road system of Mariposa County, and give a better connection with the railroad in Tuolumne County than is possessed by any of the existing roads, or could be had by any other practicable new road, and we submit the following in relation thereto:

A road along the cañon of the Merced River from the boundary of the Yosemite Valley at the Cascades, to Merced Falls, should, for constructional purposes, be divided into eleven sections, as follows:

Section 1, from the Cascades to Grouse Creek, a distance of 2.75 miles.

Section 2, from Grouse Creek to Indian Creek, a distance of 3.25 miles.

Section 3, Indian Creek to Hennessy's, a distance of 2 miles.

Section 4, Hennessy's to Ned's Gulch, a distance of 8.75 miles.

Section 5, Ned's Gulch to Filiscana Creek, a distance of 4.25 miles.

Section 6, Filiscana Creek to Colorado Gulch, a distance of 4.75 miles.

Section 7, Colorado Gulch to McCabe's Flat, a distance of 3.25 miles.

Section 8, McCabe's Gulch to Sherlock Gulch, a distance of 4 miles.

Section 9, Sherlock Gulch to Split Rock, a distance of 7.50 miles.

Section 10, Split Rock to Jones Flat, a distance of 15.25 miles.

Section 11, Jones Flat to Merced Falls, a distance of 6.25 miles.

Work on these sections may be divided into three sections:

First—Rock work, embracing the removal of large bowlders and certain jutting promontories of rock in place; the construction of heavy retaining walls and some rock "cuts and fills." The cost of this work would vary at different points, but would average $7,000 per mile.

Second—Sidehill work, where the cuts and fills would be largely in earth, with slight rock work and some timber, the cuts as a general thing equaling the fills, and at many points a slight retaining wall being a necessity, which would cost $1,800 per mile.

Third—Earth work, which would cost $700 per mile. Under this classification, the road generally follows along level and gently sloping ground, and presents but few obstacles, these mainly in the way of

bowlders, small timber, and underbrush, which would of necessity have to be removed.

To the first class of work properly belong Sections 2 and 5, making a total length of 7.50 miles, or a total cost of $52,500.

The second class embraces Sections 4, 6, 8, and 9, with a total length of 25 miles, a fair estimate of cost being $45,000.

The third class embraces Sections 1, 3, 7, 10, and 11, a total distance of 29.50 miles, at a cost of $20,650.

Making a total cost of the road, $118,150.

In addition to this, however, is bridge work, which would also include the large culverts, the small culverts being included in the road work proper. For the bridge work just mentioned, a conservative estimate would be $15,000, which would construct stone arches of great permanence wherever necessary. This all being exclusive of engineering or superintendence, which would amount to about 2.5 per cent of the cost, giving a grand total for the road completed of $136,478.75.

From the initial point, Merced Falls, with an elevation of 360 feet, to the crossing of the South Fork of the Merced River, in Section 4, the grade would vary from zero to 3 per cent, the latter being the maximum grade necessary at any point, and that only for short distances. From this point to Hennessy's the grade would increase, at times running as high as 5 per cent, which would be the maximum. From here to the Cascades the rise is much more abrupt, and at places a grade of 10 per cent would be attained. It should be noted, however, that by far the major portion of the road is but little in excess of 1 per cent, only some 4 or 5 miles having higher grades, so that it would be well within reason to expect ordinary teams to travel the greater portion of this road at a speed of 8 miles per hour, thus giving access to the Yosemite Valley in a day.

A fact worthy of note on the Merced River Cañon route is that many roads now go within a mile of the cañon of the river, and were the road built along its course these roads would soon be extended to connection with it, thus giving access to the Yosemite Valley from the north and south as well as from the west. In addition, this would afford access to the valley at all seasons of the year.

While it may be argued that the cañon of the Merced is not an all-winter route, yet we think this fact is best demonstrated by Nature, in that the Commission saw specimens of flora that exist only in semi-tropical climate, and ate fresh figs from trees growing along the cañon, even at its upper end, and within a few miles of the valley, the fig tree being one peculiarly susceptible to cold, a temperature below freezing killing it.

One of the main difficulties that has been experienced with the other roads has been dust, and a lack of good water and shade. This proposed

road, following as it does the meanderings of the Merced River, could be sprinkled from end to end at a minimum cost. With proper grade small ditches could be laid out along the side of the road, water could be readily turned into them from the river, and along their edges could be planted suitable deciduous trees, which in a short time would grow to sufficient size to give a pleasing shade to the roadway during the heat of summer, and in the winter, free from their leaves, would permit the sun to play upon the surface of the roadway and evaporate moisture.

* * * * * * * *

CONCLUSION.

The Yosemite Valley was first seen by the whites in 1851, but its existence was not generally known until the latter part of the fifties, when people commenced to visit it in increasing numbers. About 1865 the wonders of the valley had attracted sufficient attention to cause it to be set apart as a public park by an Act of Congress. Until 1874, however, access could only be had to it by trails. As early as 1869 a wagon road was projected into the valley; the work of construction on this road, however, proceeded but slowly. With the inception of this road, a natural rivalry between those sections over which previous travel had gone to the valley by trail was stimulated to such a degree that two other roads were projected, and the construction undertaken, so that the year 1874 saw three roads building to the valley, each one striving to be the first to reach it. They were the Wawona Road, the Big Oak Flat Road, and the Coulterville Road. Unfortunately, in the location of these roads, all of them followed routes for the convenience of settlers living in the high Sierras, and not direct routes from the plains of the San Joaquin Valley to the Yosemite Valley. It is worthy of note that all of these were built by private interests, as investments, from which to secure good returns. It may also be noted that they give access to the Park only from the south and west, and that there are no roads from the north and east.

All these roads reach high altitudes, and are subject to interruption to travel by reason of heavy snowfalls during a large portion of the year. In winter a great many tourists come to the Pacific Coast, and they are debarred the pleasure of visiting the valley when its great natural beauties are enhanced by the winter snows, because at this period of the year the roads now used are generally impassable. It is believed that a road through the Merced Cañon would be an all-winter route.

So far, the Federal Government has done nothing in the way of road-building, or acquiring of roads already built, in or about the Yosemite Park. The State, however, has at various times purchased and made

free the roads and trails laid out within the boundaries of the Yosemite Valley grant.

Up to 1890, but little attention had been paid to the country surrounding the Yosemite Valley. In that year Congress set aside certain lands situated in the high Sierras as a park for the people, naming it the Yosemite National Park. It may truly be said of this park that it has but one rival, and no superior, in scenic interest in the world, if even the Yellowstone Park may be considered a rival. In addition to the Yosemite Valley, now so well known, are other valleys of perhaps less magnitude, but equal grandeur—the Hetch Hetchy, the Grand Cañon of the Tuolumne, the Grand Cañon of the Tenaiya, and others, all within the National Reserve.

Situated as is this park in the main range of the Sierra Nevadas, its altitude varies from 3,000 to 13,000 feet. Peaks capped with perpetual snow are numerous; Mount Conness, Mount Hoffman, Mount Gibbs, and many others raise their heads to an elevation in excess of 12,000 feet, while Mount Lyell, Mount McClure, and Mount Dana have living glaciers of great beauty, equal in interest to those of Switzerland.

At the present time, although this is a public park, an embargo has been laid upon travel, in that all who wish to visit it must pay tribute in the way of tolls to the owners of the roads. It would appear that if the park is a free one for the people, access to it should also be free. This can be accomplished by the Government, and it would seem to be its duty either to purchase the existing roads or to construct new roads. It would not appear, however, to be just for the Government to construct a new road without making compensation for the existing roads, in that the construction of a new road, free of tolls, would mean the diversion of all the travel from the toll-roads to the free-road, which would be practically a confiscation of the toll-roads. In addition to this, it would appear exceedingly advantageous for the Government to own all the roads within the park, for in this way only can entry into the park be controlled.

Moreover, the lands within the Yosemite National Park having been exempted from entry, the value of the toll-roads has been depreciated, and through no fault of their owners; and inasmuch as this large area has been withdrawn from settlement or utilization in any manner save as a park, it would be only right that it be made a park in fact as well as in name.

Furthermore, while the existing roads are necessary for patrolling the park by the troops guarding it, still the means of communication are extremely inadequate.

Again, the cost of transportation of supplies to the troops, now carried on by means of pack trains, could be lessened to a great extent, and fires, which are a constant menace to the park, could be more readily extin-

guished were additional roads built, and the Secretary of the Interior would have better means to carry out the regulations for the government of the park.

By making free all of these existing roads, and the construction of new ones as suggested, all portions of the park could be easily reached. Following along the Tioga Road a series of lakes and streams are passed that are unequaled for fishing. The scenery is particularly grand, and there are found here a number of mineral springs which are equal to any of the famed springs of the country.

From Tuolumne Soda Springs on the Tioga Road, a road could be built along the Lyell Fork of the Tuolumne River, and reach the foot of the Lyell Glacier in the distance of 7 miles, at a cost probably not exceeding $4,000. Through this section of the park, wood, water, and grass abound, making it a paradise for campers.

The importance of a thoroughfare across the Sierra Nevada Mountains, in this region, can hardly be emphasized too strongly. Communication from the Mono Valley can be made with the Tioga Road by either of the three passes described. From Lake Tenaiya, on this road, the route would follow Tenaiya Cañon to the floor of the Yosemite Valley; thence utilizing the road already existing in the valley to the Cascades, the route could be taken down the Merced River, giving a distance from the Mono Valley on the east to the San Joaquin on the west of practically 115 miles. The necessity of this route can be more readily seen when it is stated that there are no existing roads crossing the mountains nearer than 200 miles on the south and 125 miles on the north. With such a road communication could be had between the two valleys for probably seven months of the year, while the advantages of this road for reaching the Yosemite Valley by way of the cañon of the Merced River would be an easier and more speedy trip than can be had over any of the existing routes, and this portion of the route will remain open to travel through the entire year.

A road in Tenaiya Cañon would pass through a valley only surpassed by the Yosemite in size, and only equaled by it in its ruggedness. Such a road would shorten the distance between the valley and Soda Springs more than 50 miles, and avoid the altitude reached on the Tioga Road at Snow Flat, which makes travel by that route possible for but a short season, by reason of the heavy snowfall. The magnificent cliffs and waterfalls of this cañon would alone warrant the construction of the road.

The route over the floor of the Yosemite Valley is so well known that we pass to the Cascades, the beginning of the Merced Cañon portion of the route. From here the road follows the meanderings of the Merced River at its upper portion, passing cliffs, waterfalls, and cascades of

great beauty, a fitting scenic preamble to the greater magnificence of the valley itself.

Glimpses are had of the old life of California, in the way of decaying cabins and abandoned mines, yet still the tourist may see the mining industry carried on there in all its stages, from the crude rocker and arrastra to the modern quartz-mill.

The lower portion of the cañon passes orchards and vineyards, many in a high state of cultivation, and finely debouches upon the plains of the San Joaquin at Merced Falls.

Respectfully,

S. M. MANSFIELD,
Colonel, Corps of Engineers, U. S. A.,

HARRY C. BENSON,
Captain, Fourth Cavalry, U. S. A.,

J. L. MAUDE,
Department of Highways, State of California,

Commissioners.

To the SECRETARY OF THE INTERIOR, *Washington, D. C.*

Riverton, on the Lake Tahoe State Highway.

Lake Tahoe State Highway; Easterly Approach to Stone Bridge at Riverton.

APPENDIX B.

REPORT OF THE LAKE TAHOE STATE WAGON ROAD COMMISSIONER.

MARCO VAROZZA, Commissioner.

PLACERVILLE, CAL., November 1, 1900.

To His Excellency HENRY T. GAGE, *Governor of the State of California:*

SIR: I have the honor to submit the following report on the Lake Tahoe State Wagon Road, originally established under the provisions of an Act of the Legislature of the State of California, approved April 1, 1897 (Chapter CCXLV, Statutes of 1897), which said Act was amended by an Act approved March 28, 1899 (Chapter CCLIII, Statutes of 1899), under which amendment the State Highway Commissioner was charged with the supervision of necessary plans, surveys, and specifications for contemplated work in connection with said Lake Tahoe State Wagon Road.

Under Section 2 of the last-mentioned Act, the following appropriations were provided for:

(1) Immediately available, for paying salary, traveling and other expenses incurred by the Lake Tahoe State Wagon Road Commissioner, and to pay for making of surveys, plans, and specifications by the State Highway Commissioner, the sum of $5,000.

(2) For repairing and improving said road and the structures thereon, and the building of any new necessary structures thereon, the sum of $20,000, available from and after January 1, 1900.

The Lake Tahoe Wagon Road, which is entirely situated in El Dorado County, commencing at the junction of the Newtown and Placerville roads, a short distance easterly from Smith's Flat, has its terminus at a point on the east boundary line of the State of California, at or near Lake Tahoe, traversing about 58 miles of mountainous country. Owing to the character of the country traversed, a great amount of repair work is found to be necessary to keep the road open to travel, and it has been the intention of your Commissioner to make all improvements as lasting as possible.

The following is a summary of work carried on by your Commissioner, under the superintendence and with the advice of the State Department of Highways:

Between Smith's Flat and the Five-Mile House (a distance of 2 miles) four old wooden culverts were replaced by stone structures, and considerable grading of the road was accomplished. In the work of grading this part of the road a bank of lava was uncovered and used for surfacing in this locality. From the Five-Mile House to the Fourteen-Mile House, the same nature of work was continued, viz: grading and placing of stone culverts. A wooden bridge, with dry masonry walls, was built at the bottom of the grade west of Fresh Pond, and to the east of Fresh Pond, where considerable caving of the road had occurred, a large fill was found necessary to be made.

Near the Pacific House, a wooden bridge, with dry masonry wall, 15 feet in length, together with the necessary culverts, was constructed, and a fill and retaining wall, 50 feet long and 12 feet high, were constructed in this locality, formerly the site of an old sawmill, which had been washed out.

Continuing work to Maple Grove, half a mile below Riverton, general repairs and grading were attended to, and bridges and culverts constructed.

At Riverton, where the road crosses the South Fork of the American River, it was found absolutely necessary to replace the existing old combination truss bridge with a more permanent structure. This bridge has been, for a number of years, in an unsafe condition, and has been threatened with a breakdown at any time when an ordinary heavily loaded wagon passed over it. Owing to the natural abundance of a fine quality of granite in the vicinity, and the necessity for a durable and strong structure at this point, it was decided, with the advice of the Commissioner of the Department of Highways, to erect a stone arch. A location immediately adjoining the old bridge was decided upon as affording the best foundation for such a structure; and plans and specifications were, therefore, prepared by the Department of Highways, for an 81-foot span, bids advertised for and received, and contract let to Messrs. Clark & Henery, of Stockton, as being the most favorable bidders. Work was commenced on the bridge about the beginning of June of this year, thorough inspection being made of the work during all stages of its progress. The false-work was removed from the arch on November 12, 1900, proving the solidity of the structure, which is now open for travel.

From this bridge upward, in an easterly direction along the road, general grading and repairs have been attended to, turnouts have been established, side-ditches cleaned out and repaired, and culverts replaced and constructed.

About $2\frac{1}{2}$ miles below Georgetown Junction, where the road leading over to Placer County is met, a fill and retaining wall were made, 65

Lake Tahoe and Placerville State Highway, Showing Heavy Retaining Wall.

Lake Tahoe State Highway, Showing Retaining Wall.

feet long and averaging 20 feet high, the material comprising the same being granite obtained near by.

A mile and a half west of Georgetown Junction, it was found advisable to widen the road, and this work was accomplished, and provision made to guard against the tendency of the road to wash.

Continuing to Strawberry, general repairs and maintenance were attended to, a 20-foot wooden bridge being erected 3 miles west of Strawberry, taking the place of an old fill, which has been washing out continually from year to year, owing to heavy storm-waters in this vicinity. The road was widened and stone retaining walls erected.

From Strawberry up the Slippery Ford Hill, all bowlders were removed, blasting being done where necessary, and a surfacing laid up the hill of cedar bark, covered with six or seven inches of dirt. Two stone culverts were placed in this vicinity; and it has been found by your Commissioner that these improvements have been approved of by the general traveling public on the road.

Beyond this point, and as far as the western terminus of the road, general repairs of the road have been attended to.

It is the opinion of your Commissioner that this road is in much better condition at the present time than it has been for a number of years, although there is a great deal of opportunity for further improvement, which can only be accomplished by further appropriations to enable the work of maintenance of the road to be continued, with the end in view of placing in position permanent structures, in the way of masonry retaining walls, stone and vitrified pipe culverts, and durable bridges, so that the cost of maintenance may be gradually lessened. Under the advice of the Commissioner of the Department of Highways, about 800 feet of vitrified pipe has been purchased, the same ranging in size from 4 to 16 inches, to be used in the construction of culverts along the highway.

This great interstate highway, if properly maintained, is of great benefit to California and Nevada, as well as affording unlimited pleasure to the thousands of pleasure-seekers and tourists who annually visit the beautiful lakes and streams of the lofty Sierras. While the fund for its actual maintenance, which is contained in the General Appropriation, is generally adequate, it will be absolutely necessary to replace a large number of the old culverts and drainways along the road with new and permanent structures, as well as to repair many of the old bridges along the highway, and this will require a further substantial appropriation. The heavy winter storm-waters make it necessary that these should be of a substantial character, and, unless this work can be accomplished, there is great danger of large washouts occurring at various points along the road.

The re-surveying of the road by the engineering force of the Depart-

ment of Highways has been commenced, and, this work coming immediately under the supervision of Mr. Maude, I presume that he will report on the same.

In closing this report, I desire to extend to your office thanks for the kind interest manifested in relation to the road, and I also wish to express my thanks to Hon. J. L. Maude, Commissioner of Highways, for his ready assistance in all matters in connection with our joint duties on the road.

Respectfully submitted.

MARCO VAROZZA,
Commissioner.

FINANCIAL REPORT OF COMMISSIONER OF LAKE TAHOE STATE ROAD.

1899			1899		
Mar. 31—	Chas. Sandfoss	$1 25	May 31—	R. Varozza	$63 75
	J. H. Zimmerman	3 25		V. Campini	61 25
	Wm. Martin	6 00		A. Bon	49 00
	Joseph Waring	9 00		M. Simone	49 00
	M. Varozza, Comm'r	9 65		Dan G. Carr	50 00
	H. Phelps	32 00		J. Beffa	20 00
	Susie Stewart	1 75		Frank Phelps	50 00
	Susie Stewart	5 00		Harry Phelps	46 00
	Thos. Alderson	9 75		E. F. Walsh	48 00
	Mary L. Papina	50		Ed Jones	36 00
	Sunset Telephone Co.	2 20		Frank Phelps	50 00
	M. Ryan	60 00		Harry Phelps	40 00
	E. Jones	32 00		J. De Bernardi	108 00
	M. Simone	22 00		Geo. Marquini	69 00
	F. Phelps	10 00		M. Varozza	36 00
	H. Phelps	10 00		Thos. Alderson	25 00
	M. Ryan	62 50		Harry Phelps	96 00
	Ed Jones	30 00		J. Zimmerman	3 50
	M. Simone	20 00		Lou Pratt	2 50
	Frank Phelps	24 00		Wm. Martin	3 00
	Ed Jones	24 00		Chas. Sandfoss	2 50
	M. Simone	16 00		Mountain Democrat	2 50
	Frank Phelps	34 00		A. J. Selio	2 00
	Harry Phelps	32 00		M. Varozza	1 85
	Ed Jones	16 00		R. Varozza	105 00
	Geo. Blakeley	12 00		P. Varozza	60 00
	Frank Phelps	20 00		P. Michalitti	67 50
	Frank Phelps	16 00		A. Bon	52 00
	Antone Berry	20 00		M. Simone	52 00
May 31—	F. R. Stephens	10 00		V. Campini	40 00
	J. H. Zimmerman	4 00		Frank Phelps	52 00
	Chas. Sandfoss	4 00		Harry Phelps	2 00
	R. L. Weibught	2 50		E. F. Walsh	26 00
	Peter Millbrook	2 00		Dan G. Carr	44 00
	George Marquini	76 50		D. E. Cappi	34 00
	Harry Phelps	12 00		M. Ryan	62 50
	J. De Bernardi	106 00		M. Ryan	12 50
	M. Varozza	33 00		M. Ryan	42 50
	Thos. Alderson	37 94	Oct. 30—	M. Varozza	10 00
	Rico Varozza	101 50		M. Varozza	5 00
	P. Michalitti	63 75		M. Varozza	10 00

FINANCIAL REPORT—LAKE TAHOE STATE ROAD—Continued.

1899		
Oct. 30—	Francis Frey	$78 00
	M. Varozza	22 00
	Francis Frey	81 00
	Sunset Telephone Co.	1 00
	Chas. Sandfoss	5 00
	M. Varozza	50
	D. E. Copple	22 50
	Harry Phelps	10 00
	D. E. Copple	20 00
	Harry Phelps	10 00
	Alex Cowen	6 00
	D. E. Copple	20 00
	Rico Varozza	65 00
	Will Frey	52 00
	D. E. Copple	10 00
	Harry Phelps	8 00
	Ed Jones	30 00
	M. Ryan	20 00
	R. Varozza	67 50
1900	Will Frey	54 00
Apr. 11—	J. C. Stevens	9 00
	James Davis	5 00
	Francis Frey	3 00
	J. H. Zimmerman	3 00
	Henshaw, Buckley & Co.	325 00
	Southern Pacific Co.	14 19
	Sunset Telephone Co.	1 01
	N. Wonderly	4 90
	Studebaker & Co.	375 00
	J. Jingo	5 00
	Peter Fox	1 25
	Marco Varozza	11 90
	Frank Phelps	64 00
	Harry Phelps	10 00
	Marco Varozza	10 00
	Rico Varozza	20 00
	John Bassi	6 00
	Wm. Watson	7 50
	Watson Marks	22 00
	John Varozza	8 00
	Rico Varozza	10 00
	Notary fee	50
	Francis Frey	7 50
May 28—	J. S. Creighton	29 70
	Wm. Rust	50
	Thos. Alderson	68 81
	Ben Fossatti	1 20
	M. Dunkum	1 00
	Wm. Watson	75 00
	George Meyers	43 00
	George Hilbert	47 50
	Samuel Simone	32 00
	L. Biagotti	38 00
	John Bassi	50 00
	Gregorio Papini	39 00
	Watson Marks	189 00
1900		
May 28—	Rico Varozza	$77 50
	J. B. Varozza	112 00
	Marco Varozza	12 00
	Notary fee	50
Sept. 17—	Capitol Sewer Pipe W'ks	273 75
	Mountain Democrat	4 50
	Rico Varozza	67 50
	John Bassi	67 50
	J. B. Varozza	108 00
	V. J. Campini	10 00
	Wm. Watson	52 50
	Gregorio Papini	52 00
	Samuel Simone	52 00
	Lugi Biagotti	46 00
	John Hartman	38 00
	Watson Marks	168 00
	George Meyer	45 00
	Geo. H. Hilbert	42 00
	Francis Frey	24 00
	Marco Varozza	57 65
	Thos. Alderson	28 35
	Marks & Underwood	4 50
	Frank Phelps	24 00
	Orin C. Phelps	23 00
	Wm. Martin	40 00
	Rico Varozza	65 00
	J. B. Varozza	104 00
	John Bassi	65 00
	Wm. Watson	2 50
	V. J. Campini	52 00
	Gregorio Papini	52 00
	Samuel Simone	52 00
	John Hartman	52 00
	Lugi Biagotti	50 00
	Watson Marks	64 00
	Geo. Marquini	36 00
	D. E. Copple	8 00
	Marco Varozza	32 50
	Sunset Telephone Co.	3 30
	J. C. Stephens	6 00
	Thos. Alderson	13 35
	Rico Varozza	65 00
	John Bassi	65 00
	J. B. Varozza	104 00
	V. J. Campini	52 00
	Gregorio Papini	52 00
	Samuel Simone	52 00
	John Hartman	50 00
	Lugi Biagotti	52 00
	Geo. Marquini	50 00
	D. E. Copple	50 00
	Sunset Telephone Co.	3 60
	Marco Varozza	5 40
	Marco Varozza	19 50
	Thos. Alderson	13 50
	J. & J. Blair	14 45

FINANCIAL REPORT—LAKE TAHOE STATE ROAD—Continued.

1900		1900	
Sept. 17—Francis Frey	$18 00	Sept. 17—Francis Frey	$20 00
F. Brown	5 50	Watson Marks	64 00
R. G. Small	18 00	Sept. 5—Marco Varozza (first payment on bridge)	6,244 00
F. Brown	8 75		
Francis Frey	30 00		

APPENDIX C.

EXPENDITURES FOR ROADS FROM 1898 TO 1900.

Counties.	1898–1899.	1899–1900.	Total.
Alameda	$61,954 23	$66,078 72	$128,032 95
Alpine	1,076 22	1,119 12	2,195 34
Amador	17,490 50	16,104 02	33,594 52
Butte	46,027 62	45,661 28	91,688 90
Calaveras	12,862 86	12,283 01	25,145 87
Colusa	27,353 89	30,974 80	58,328 69
Contra Costa	46,159 21	48,631 06	94,790 27
Del Norte	5,449 78	5,415 98	10,865 76
El Dorado	12,872 45	12,779 90	25,652 35
Fresno	48,483 58	60,427 26	108,910 84
Glenn	18,255 06	20,113 14	38,368 20
Humboldt	44,579 60	46,310 48	90,890 08
Inyo	2,971 38	3,367 54	6,338 92
Kern	24,303 00	26,269 65	50,572 65
Kings	10,713 04	10,760 33	21,473 37
Lake	12,473 08	12,857 72	25,330 80
Lassen	9,690 31	8,670 51	18,360 82
Los Angeles	99,994 48	123,057 21	223,051 69
Madera	13,188 07	19,747 64	32,935 71
Marin	18,677 40	20,889 55	39,566 95
Mariposa	6,130 83	7,061 28	13,192 11
Mendocino	28,624 81	32,361 96	60,986 77
Merced	27,715 47	29,149 20	56,864 67
Modoc	8,015 76	9,772 74	17,788 50
Mono	2,831 04	2,524 78	5,355 82
Monterey	32,084 06	47,814 38	79,898 44
Napa	22,205 64	21,737 44	43,943 08
Nevada	16,654 36	16,861 00	33,515 36
Orange	21,621 02	24,635 62	46,256 64
Placer	20,649 90	20,461 28	41,111 18
Plumas	8,751 88	12,132 82	20,884 70
Riverside	10,639 42	14,770 17	25,409 59
Sacramento	48,237 24	48,464 60	96,701 84
San Benito	12,046 92	11,541 35	23,588 27
San Bernardino	28,454 21	35,082 48	63,536 69
San Diego	27,114 21	32,883 02	59,997 23
San Francisco*	----------	----------	----------
San Joaquin	29,618 64	50,379 99	79,998 63
San Luis Obispo	24,519 19	36,235 41	60,754 60
San Mateo	62,580 96	69,660 36	132,241 32
Santa Barbara	28,153 98	33,298 25	61,452 23
Santa Clara	91,018 72	122,658 48	213,677 20
Santa Cruz	25,935 23	26,519 35	52,454 58
Shasta	15,070 72	16,598 25	31,668 97
Sierra	5,645 24	5,759 00	11,404 24
Siskiyou	16,247 08	23,118 28	39,365 36
Solano	35,546 84	48,187 96	83,734 80
Sonoma	59,110 80	68,137 80	127,247 88
Stanislaus	21,430 23	21,773 55	43,203 78
Sutter	10,873 05	10,287 53	21,160 58
Tehama	30,032 43	25,544 74	55.577 17
Trinity	4,318 96	4,404 46	8,723 42
Tulare	28,562 89	30,896 64	59,459 53
Tuolumne	14,601 96	16,508 31	31,110 27
Ventura	24,068 29	24,978 70	49,046 99
Yolo	41,147 17	32,126 43	73,273 60
Yuba	5,726 62	5,849 59	11,576 21
Totals	$1,430,560 81	$1,631,696 11	$3,062,256 92

*San Francisco: Incorporated as a city and county. No expenditures on roads.

APPENDIX D.

EXPENDITURES OF DEPARTMENT UP TO AND INCLUDING NOVEMBER, 1900.

1899	
Aug. 19—Charles Prince	$30 00
Sept. 4—R. O. Kimbrough	12 00
Wells, Fargo & Co.	2 30
Pacific Wheel and Carriage Works	37 40
Sayre & Son	8 00
J. C. Irvine & Co.	12 00
Wyckoff, Seamans & Benedict	87 00
Sunset Tel. & Tel. Co.	13 40
Thomas Fox, P. M.	5 00
Charles Prince	30 00
Oct. 31—Charles Prince	60 00
Dec. 5—Charles Prince	30 00
Dec. 12—Western Union Tel. Co.	25
W. K. Cothrin	6 20
William Carragher	9 00
Harry M. Bowman	20 00
D. McKay	9 00
Bolton & Strong	6 55
Western Union Tel. Co.	2 82
J. L. Maude	14 25
C. J. DeMerritt	4 00
Sunset Tel. & Tel. Co.	6 10
Frank H. Wing	2 25
Western Union Tel. Co.	1 32
Wells, Fargo & Co.	2 10
Whisky Hill Wells	4 50
John T. Stoll	3 00
Sunset Tel. & Tel. Co.	5 50
Capital & Sac'to Transfer Co.	1 00
Mason's Steam Laundry	4 50
Western Union Tel. Co.	1 26
Miller Bros.	25
C. Suter	1 15
Thomas Fox, P. M.	10 00
Electrical Engineering Supply Co.	4 90
J. A. Green	60
D. McKay	10 00
Sunset Tel. & Tel. Co.	5 50
Western Union Tel. Co.	77
Wells, Fargo & Co.	35
Sunset Tel. & Tel. Co.	25
Lodi Hotel	50
Lodi Hotel	50

1899	
Dec. 12—J. L. Maude	$2 85
1900. J. L. Maude	2 85
Jan. 2—Charles Prince	30 00
Feb. 1—Charles Prince	30 00
Feb. 3—Geo. H. Fuller Desk Co.	143 50
Feb. 8—Fashion Stables	52 30
A. Meister & Son	1 70
John Breuner	4 50
Fashion Stables	32 60
Fashion Stables	19 35
D. Johnston & Co.	1 70
Dr. C. L. Megowen	5 00
Fashion Stables	59 15
Wells, Fargo & Co.	1 55
Whisky Hill Wells	4 50
W. K. Cothrin	8 45
Western Union Tel. Co.	79
Mason's Steam Laundry	4 50
Wells, Fargo & Co.	1 35
Southern Pacific Co.	50
B. W. Lavell	25
Palace Hotel	2 50
C. W. Vickrey	10 15
J. C. Irvine & Co.	10 00
Southern Pacific Co.	50
Sunset Tel. & Tel. Co.	45
Western Union Tel. Co.	3 69
Thomas Fox, P. M.	10 00
Mar. 1—Charles Prince	30 00
Mar. 15—Wyckoff, Seamans & Benedict	35 00
J. L. Maude	5 10
Sunset Tel. & Tel. Co.	5 50
Dr. C. L. Megowen	2 50
H. C. Carter	26 00
Wells, Fargo & Co.	80
Western Union Tel. Co.	3 29
Sunset Tel. & Tel. Co.	7 25
Fashion Stables	63 95
Apr. 4—H. S. Crocker Co.	55
W. F. Purnell	1 50
Fashion Stables	15 80
Whisky Hill Wells	4 50
Western Union Tel. Co.	55
W. F. Purnell	35
Charles Prince	30 00
Mason's Steam Laundry	4 50

EXPENDITURES OF DEPARTMENT—Continued.

1900		
Apr. 4	Sunset Tel. & Tel. Co.	$5 75
Apr. 20	Charles Prince	30 00
May 22	Charles Prince	30 00
June 4	Union Lithograph Co.	1 25
	R. O. Kimbrough	1 50
	R. O. Kimbrough	55
	H. J. Furley	10 00
	Wells, Fargo & Co.	45
	Sunset Telephone Co.	7 60
	J. O. Coleman, P. M.	10 00
	Wells, Fargo & Co.	10 15
	Western Union Tel. Co.	49
	Sunset Tel. & Tel. Co.	7 10
	John Breuner Co.	4 25
Aug. 7	Charles Prince	30 00
Aug. 17	Charles Prince	30 00
Aug. 31	Charles Prince	30 00
Sept. 24	Charles J. Noack	8 50
	J. L. Maude	35 25
	Hotel Arlington	8 00
	Sunset Telephone Co.	7 10
1900		
Sept. 24	John Breuner Co.	$10 00
	Mason's Steam Laundry	4 50
	Whisky Hill Wells	4 50
	Buffalo Brewing Co.	30
	Wells, Fargo & Co.	2 20
	Sunset Telephone Co.	4 65
	Sunset Telephone Co.	5 50
	Wells, Fargo & Co.	1 00
	Sunset Telephone Co.	5 95
	Western Union Tel. Co.	40
	J. O. Coleman, P. M.	5 00
	W. K. Cothrin	10 80
	Wells, Fargo & Co.	25
	Sunset Telephone Co.	9 80
	J. O. Coleman, P. M.	5 00
	Charles Prince	4 50
	Whisky Hill Water Co.	4 50
	Charles Prince	30 00
	D. McKay	10 00
	Western Union Tel. Co.	4 37

APPENDIX E.

EXPENDITURES FROM TIOGA FUND.

1899		
Sept. 5	Henry Kahn & Co.	$58 00
	John R. Carr	42 05
	P. C. Johnson & Co.	21 00
	Hall, Luhrs & Co.	52 45
	Kirk, Geary & Co.	116 70
	Holbrook, Merrill & Stetson	9 00
	Wawona Hotel Co.	37 61
	U. S. Q. M. Dept.	12 35
Oct. 31	Paul Renie	80 00
	Henry Carter	98 65
Dec. 14	Locke & Lavenson	15 50
	Rafael, Weil & Co.	13 10
	Nevill & Co.	4 50
	Clabrough-Golcher Co.	8 00
	John Breuner Co.	82 89
	Southern Pacific Co.	49 02
	Weinstock, Lubin & Co.	60
	J. C. Johnson & Co.	25 00
	Shaw Bros.	1 10
	Holbrook, Merrill & Stetson	9 00
	Rosenwald, Kahn & Co.	2 62
	John R. Kerr	54 50
	Wells, Fargo & Co.	8 25
	George Fisk	50 00
	Sentinel Hotel	4 50
	John Trabucco	7 15
	Mariposa Hotel	5 50
	John Trabucco	75
	The New Market	1 60
	Mrs. R. W. Greeley	25 00
	The Wawona Hotel Co.	46 45
	Yosemite Stage and Turnpike Co.	110 49
	A. F. Bruce	4 60
	Yosemite Stage and Turnpike Co.	5 30
	Yosemite Falls store	2 20
	James Halsted	18 85
	W. H. Dudley	6 50
	Percy Davis	4 15
	G. W. Hammell	75
	W. A. Sale	1 35
	J. P. F. Murray	1 00
	L. Boyle & Son	1 25
	Hammon & Bates	55
	Mrs. N. H. Tull	3 10
1899		
Dec. 14	Phœnix Livery and Feed Stable	$4 50
	Galt Hotel	4 50
	Southern Pacific Co.	12 13
	Stephen Butler, Jr.	2 00
1900.	D. Johnston & Co.	1 70
Mar. 16	J. L. Maude	6 35
	Hotel St. Nicholas	18 00
	Palace Restaurant	10 00
	Mrs. Irvine	48 00
	John Breuner Co.	19 64
	A. Leitz Co.	194 20
June 4	Fashion Stables	15 00
	Fred I. Monson	307 52
	H. J. Furley	35 00
	W. P. Fuller & Co.	10 00
	George B. Stack	18 00
	H. J. Furley	20 00
	A. Leitz Co.	27 75
	H. S. Crocker Co.	87 40
	John Breuner	24 50
	Nevill & Co.	165 30
	Max Eichrodt	4 92
	Holbrook, Merrill & Stetson	25 00
	Southern Pacific Co.	50
	Schaw, Ingram, Batcher & Co.	31 40
	John Breuner Co.	26 25
	Holbrook, Merrill & Stetson	3 00
	C. Suter	2 40
	M. J. Bannon	1 75
	Southern Pacific Co.	1 03
	J. A. Green	19 80
	Capital & Sac'to Transfer Co.	1 75
	R. O. Kimbrough	15
	Lindley & Co.	265 91
	Kimball & Upson	10 80
	Jacox Bros.	5 00
	John T. Stoll	9 60
	Weinstock, Lubin & Co.	71 50
	Capital & Sac'to Transfer Co.	3 00
	Wassermann, Kaufmann & Co.	2 94
	Kirk, Geary & Co.	28 95

EXPENDITURES FROM TIOGA FUND—Continued.

1900		
June 4—	Southern Pacific Co.	$112 80
	Fashion Stables	83 15
	Richard Happ	2 50
	H. Turner	7 20
	D. McDougall	135 00
	J. L. Maude	294 80
Aug. 7—	L. A. Wallace	80 00
Aug. 16—	John T. Stoll	135 25
	C. W. Lamphrey	80 00
Sept. 24—	J. L. Maude	4 40
	A. Leitz Co.	3 50
	Kirk, Geary & Co.	9 60
	C. L. Megowen	10 00
	D. McKay	12 00
	Carey House	3 00
	J. C. Stephens	9 30
	Southern Pacific Co.	8 46
	Southern Pacific Co.	1 43
	Francis Frey	9 00
	Wm. Martin	2 25
	Lakeside House	8 00
	The Latest	2 50
	Chris Neilson	1 25
	Richard Bartels	7 25
	Fred Hardy	3 50
	D. Hayes & Bro.	2 25
	A. D. Waltze	4 00
	H. L. Leavitt	3 00
	E. Pierson	3 00
	W. E. Reading	1 25
	Harvey Boone	10 60
	Occidental Hotel	2 75
	P. G. Hughes	2 50
	G. W. Vansickle	75
	H. L. Leavitt	8 00
	A. D. Waltze	7 00
	Sentinel Hotel	18 00
	Kaufmann & Kenney	37 00
	H. W. Nelson	3 50
	G. W. Vansickle	75
	D. Hayes & Bro.	65
	A. D. Waltze	2 75
	Leavitt House	2 00
	Bodie Ry. & Lumber Co.	18 60
	A. Leitz Co.	13 00
	Sentinel Hotel	5 25
	Sentinel Hotel	15 75
	J. Bauquier	4 00
	Robert Murray	16 50
	D. McKay	5 00
1900		
Sept. 24—	Sentinel Hotel	$3 00
	Kaufmann & Kenney	12 00
	Kaufmann & Kenney	45 00
	J. P. Hammond	10 00
	P. Sislini	17 00
	W. P. Campbell	23 50
	D. W. Hayes	133 35
	Sentinel Hotel	22 50
	John McCauley	1 75
	Hale Bros.	07
	Adam Farrington	512 50
	W. J. Farrington	130 00
	Jesus Cruz	120 00
	Adam Farrington	53 05
	Bodie Toll-Road	25
	A. D. Waltze	3 00
	P. G. Hughes	5 00
	Mrs. T. C. Sharp	2 50
	Fred Hardy	1 00
	H. L. Leavitt	3 00
	Nucleus Hotel	2 00
	Fred Steinman	1 00
	W. Radley	4 00
	Mrs. H. W. Jones	6 00
	Kimball & Upson	4 45
	C. H. Parish	1 00
	L. H. Pratt	1 00
	A. J. Celio	7 00
	Hale Bros.	25
	F. C. Frey	9 50
	Larkin Bros.	2 00
	Mrs. L. Fauret	1 00
	Mrs. A. Naugley	50
	Marks & Woodward	4 00
	Alden & Campini	65
	Southern Pacific Co.	52 92
	Leo Solomon	122 65
	Capital and Sacramento Transfer Co.	3 00
	John T. Stoll	2 75
	Harold J. Furley	525 00
	Victor Noble	160 00
	Henry Carter	135 00
	C. W. Vickrey	24 00
	H. S. Crocker Co.	20
	T. W. McAuliffe & Co.	60
	H. J. Furley	31 05
	G. R. Gross	165 00
	J. L. Maude	186 70
	Wawona Hotel Co.	23 00

APPENDIX F.

EXPENDITURES FROM LAKE TAHOE WAGON ROAD FUND.

1900		
Mar. 16	J. H. Zimmermann	$6 00
	The Carey House	10 00
	A. Leitz Co.	273 00
	Hotel St. Nicholas	30 70
	J. L. Maude	14 75
June 4	J. H. Zimmerman	7 50
	Marks & Woodward	16 00
	Francis Frey	30 00
	The Carey House	6 00
	J. L. Maude	32 25
	W. F. Purnell	2 00
	H. S. Crocker Co.	14 60
	Fashion Stables	31 30
	Robert Kirk	215 65
	Wm. H. Wheeler	50 00
	Western Union Tel. Co.	45
	Harlow Bros.	6 00
	The Bee	16 90
1900		
June 4	Record-Union	$20 00
	C. Suter	15 30
	State Prison, Folsom	275 00
	David Megowen	28 80
	Southern Pacific Co.	76
	Fairbanks, Morse & Co.	119 00
	Thomas Fraser	2 00
	H. J. Furley	10 00
Aug. 16	J. M. Miller	680 00
Sept. 24	A. Leitz Co.	15 00
	J. F. Hill Carriage Works	17 00
	The Ohio House	2 00
	Marks & Woodward	16 00
	Baker & Hamilton	97 00
	A. Leitz Co.	30 00
	Kimball & Upson	6 80
	J. L. Maude	41 45
Oct. 5	J. M. Miller	570 00

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SEVENTH BIENNIAL REPORT

OF THE

TRUSTEES OF MINERAL CABINET

FOR THE

TWO YEARS ENDING JUNE 30, 1900.

SACRAMENTO:
A. J. JOHNSTON, : : : : : SUPERINTENDENT STATE PRINTING.
1901.

To the Hon. Henry T. Gage, *Governor :*

Sir : The Trustees of the Mineral Cabinet, authorized by an Act of the Legislature entitled "An Act to provide for the removal of the Mineral Cabinet from the State Library," approved March 9, 1887, have the honor herewith to submit their seventh biennial report.

Respectfully,

GEO. PYBURN,

J. A. WOODSON,

H. WEINSTOCK,

Trustees.

E. B. Crocker Art Gallery, Sacramento,

June 30, 1900.

REPORT

OF THE

TRUSTEES OF MINERAL CABINET.

The janitor of the E. B. Crocker Art Gallery, where the State Mineral Cabinet is now located and on public view, reports to us that, during the two years last past, over 6,700 (annually) visitors have registered, and that at least one half of these have come to view the mineral exhibit. Since the date of report of June 30, 1898, no work has been done by the Trustees, either on the Cabinet or its contents, further than to make repairs of glass broken by accident, or by thieves in their efforts to abstract valuable mineral specimens.

Some time in March of this year the glasses in some of the cases were broken and several valuable gold specimens were abstracted therefrom. Although the thieves were traced to the receiver, and the *material* of the specimens recovered, yet they were broken up so completely as to destroy much of their value. It seems impossible to guard against the theft of gold specimens of any bullion value, but the best precautions possible have hitherto been taken.

We desire to call the attention of the Governor to the fact, already mentioned in previous reports (the fourth and fifth), that the Act (Assembly Bill No. 134, approved March 9, 1887) creating the commission, "Trustees of the Mineral Cabinet," prescribed as the duty of said Trustees, *the removal of Mineral Cabinet from the State Capitol*, where it was at that time situated, *to the E. B. Crocker Art Gallery*, where it now is. They were not charged with the continued or future custody or care of the Cabinet and minerals, nor was any provision made in the Act to that end. But for the fact that certain improvements proposed by the Trustees, and sanctioned by the Legislature, were made the subject and cause for appropriations of money, the prescribed duties of the Trustees would have been fulfilled, and their functions terminated. *The Cabinet would, under such circumstances, be without any responsible*

guardian. In view of this state of affairs, and the near completion of the work of ordering and improving, we respectfully suggest that you recommend to the coming Legislature an amendment to Assembly Bill No. 134, aforesaid, making it the duty of the Trustees to continue to keep and care for said Cabinet, without salary, as hitherto.

The following is the only outlay which has been made since last report:

C. H. Krebs & Co. for replacing glass covers to cases before mentioned..$1 00

Respectfully submitted.

GEO. PYBURN,
J. A. WOODSON,
H. WEINSTOCK,
Trustees.

REPORT

ON THE

BUILDING AND LOAN ASSOCIATIONS

OF THE

STATE OF CALIFORNIA,

BY THE

BOARD OF COMMISSIONERS OF THE BUILDING AND LOAN ASSOCIATIONS,
IN ACCORDANCE WITH AN ACT OF THE LEGISLATURE,
APPROVED MARCH 23, 1893,

TO

His Excellency Henry T. Gage, Governor of the State of California.

OCTOBER 1, 1899.

SACRAMENTO:
A. J. JOHNSTON, : : : : : SUPERINTENDENT STATE PRINTING.
1899.

REPORT.

OFFICE OF THE BOARD OF COMMISSIONERS OF THE
BUILDING AND LOAN ASSOCIATIONS,
SAN FRANCISCO, CAL., October 1, 1899.

To HIS EXCELLENCY HENRY T. GAGE,
Governor of the State of California:

SIR: Pursuant to the requirements of the Act of March 23, 1893, creating the Board of Commissioners of the Building and Loan Associations, we present herewith the sixth annual report of this office, covering the work of this Board for the fiscal term from June 1, 1898, to May 31, 1899, inclusive.

This report comprises the details and compilations from the annual reports of 151 associations in active operation, and which had then been doing business for more than one year.

Under the law as it now stands, associations are only required to report to this office at the close of their several fiscal years, or within thirty days thereafter, as of that date; hence the last reports for the fiscal term covered by our report can only reach this office about July 1st, after which they have to be examined and the tabulations made to show the Assets and Liabilities, Receipts and Disbursements, and other necessary statistical tables required to enable us to arrive at a clear understanding of the trend of the business.

Under existing conditions it is impossible to present a history of the affairs of all associations, as of any specific date, for the reason that these annual reports fall due during each and every month of the year. To remedy this defect, the law should be so changed as to require two reports each year, one as now made and one at some specific date, or so as to require all associations, heretofore or hereafter formed, to so change the time of making their annual reports that they will fall due on January 1st or July 1st of each year. With such a change in the law it would then be possible to present a report of the business of the entire State in a form that would be of material benefit to all concerned.

These associations fill a sphere that no other financial institutions can fill, but like all other institutions that aim to handle the savings of the public, they must be honestly and economically managed; features that have a tendency to cause the public to believe that they aim to

charge "all the traffic will bear" must be eliminated, otherwise their usefulness will be impaired and the confidence of the public cannot be fully gained or maintained.

The principles under which they operate, aim to encourage and enforce small savings and are especially calculated to meet the requirements of persons of small means, who desire a safe and profitable method of increasing their surplus earnings, and only such as have availed themselves of the opportunities offered can fully appreciate the benefits accruing.

During the past five years this country has been passing through the most severe financial strain in its history; every financial and business enterprise has been tried to its utmost; failures have been numerous, losses great, and profits small. That the building and loan associations have weathered the storm and emerged in as good shape as the reports show them to be in is a wonder and speaks volumes in favor of the system. With the return of prosperity those already formed should reap increased rewards and new localities should form new associations and compete for the benefits that may thus accrue to their respective precincts.

GENERAL STATUS.

Number of associations reporting at last report		148
Associations reporting for the first time		4
Richmond Mutual—	San Francisco.	
Borrowers' Mutual—	Los Angeles.	
Salinas Mutual—	Salinas.	
Globe Mutual—	San Francisco.	
Total		152
Retired		1
Corning Mutual—	Corning.	
Number reporting in 1899		151
New associations for year ended May 31, 1899		3
Los Angeles County Mutual—	Pasadena.	
Fullerton Mutual—	Fullerton.	
Covina Mutual—	Covina.	
Resumed business		1
West Shore Mutual—	San Francisco.	
Total active May 31, 1899		155
Liquidating voluntarily		2
Co-op. Mutual—	San Francisco.	
Yerba Buena Mutual—	San Francisco.	
Liquidating by receivers		2
Imperial S. & L. Co.—	Los Angeles.	
Union Building & Loan—	Sacramento.	2
Total roll June 1, 1899		159

During the past year the Enterprise Mutual of San Francisco has completed liquidation, paying shareholders ninety-two cents on the dollar; since June 1st we are advised that the "Homeseekers" and

"Borrowers" of San Francisco, the "Occidental" of Sacramento, and the "San Diego Savings and Loan" of San Diego propose to voluntarily liquidate and retire from business at an early date. The reports of all these appear in their proper places in the "Reports of Associations" herein.

GROWTH OF THE BUILDING AND LOAN BUSINESS.

To illustrate the growth of the system of coöperative investment in this State, we append the following table showing the associations in existence during each of the following years since the date of its earliest introduction:

1872	1 association.	1888	49 associations.
1874	2 "	1889	82 "
1875	5 "	1890	105 "
1876	6 "	1891	126 "
1879	7 "	1892	136 "
1881	9 "	1893	146 "
1882	11 "	1894	153 "
1883	14 "	1895	153 "
1884	16 "	1896	155 "
1886	31 "	1897	157 "
1887	44 "	1898–9	159 "

Yet, in face of all that has been done by the advocates of the system, one half of the counties in the State have never had an association organized within their limits, and numerous localities in counties already favored could realize material benefit from the operation of a conservative, well-managed association doing business within their respective precincts with the capital and savings of their own citizens. The portions of the State partially covered by associations now in active existence is the better shown by the following:

DISTRIBUTION BY COUNTIES.

Alameda	14 associations.	San Diego	4 associations.
Fresno	1 "	San Francisco	69 "
Humboldt	1 "	San Luis Obispo	1 "
Kern	2 "	San Joaquin	2 "
Los Angeles	21 "	San Mateo	2 "
Marin	3 "	Santa Barbara	1 "
Merced	1 "	Santa Clara	6 "
Mendocino	3 "	Santa Cruz	1 "
Monterey	1 "	Solano	1 "
Napa	1 "	Sonoma	3 "
Orange	4 "	Stanislaus	1 "
Placer	1 "	Tulare	2 "
Sacramento	3 "	Ventura	2 "
San Bernardino	3 "	Yolo	1 "
28 counties			155 associations.

ASSETS AND LIABILITIES.

The gross assets of the 151 associations whose annual terms closed within the fiscal term ended May 31, 1899, amount to $20,285,454 24; this is $485,772 48 less than the assets of the 148 associations that were reported in the Annual Report of 1898, and the details may be set forth as follows:

ASSETS.

Loans	$16,739,104 62
Arrearages	521,603 74
Cash on hand	623,999 90
Real estate	2,151,466 19
Other assets	249,279 79
Total	$20,285,454 24

LIABILITIES.

Dues—Installment stock	$12,872,670 70
Paid-up and prepaid stock	1,519,541 90
Earnings apportioned	4,052,999 80
Advance payments	76,010 50
Overdrafts and bills payable	784,159 67
Reserve and undivided profits	440,309 63
Unearned premium	175,948 77
Other liabilities	363,813 27
Total	$20,285,454 24

COMPARISON OF ASSETS AND LIABILITIES.

That the situation may the better be understood and analyzed, the assets and liabilities, and the receipts and disbursements for 1897, 1898, and 1899 are presented side by side:

ASSETS.

	1897.	1898.	1899.
Loans	$18,526,632 53	$17,627,875 63	$16,739,104 62
Arrearages	584,730 52	506,122 17	521,603 74
Cash	570,222 68	610,612 71	623,999 90
Real estate	1,728,474 66	1,761,625 87	2,151,466 19
Other assets	381,866 42	264,990 34	249,279 79
Totals	$21,791,928 81	$20,771,226 72	$20,285,454 24

LIABILITIES.

	1897.	1898.	1899.
Installment stock	$13,496,581 45	$13,107,176 69	$12,872,670 70
Paid-up and prepaid stock	1,078,041 28	1,231,121 75	1,519,541 90
Earnings	4,565,063 17	4,342,436 79	4,052,999 80
Advance payments	48,213 58	65,592 29	76,010 50
Overdrafts and bills payable	1,508,438 35	938,895 74	784,159 67
Reserve and undivided profits	718,448 50	450,209 63	440,309 63
Unearned premium	------------	234,075 63	175,948 77
Other liabilities	377,142 48	401,718 20	363,813 27
Totals	$21,791,928 81	$20,771,226 72	$20,285,454 24

RECEIPTS.

	1897.	1898.	1899.
Balance last report	$534,465 67	$560,414 35	$615,033 83
Installment stock	3,399,814 57	3,323,550 90	3,316,486 34
Paid-up and prepaid stock	350,135 80	517,880 47	689,329 21
Interest	1,287,365 50	1,241,275 25	1,237,176 49
Premium	427,683 18	406,206 91	371,391 38
Fines	29,744 07	29,209 11	30,616 33
Fees	10,038 35	17,743 00	5,957 75
Loans repaid	3,686,805 58	4,156,450 66	4,370,166 04
Overdrafts and bills payable	1,472,193 74	1,058,661 95	887,580 21
Other receipts	1,058,981 11	819,478 52	824,399 99
Totals	$12,257,227 57	$12,130,871 12	$12,348,137 57

DISBURSEMENTS.

	1897.	1898.	1899.
Overdrafts and bills payable	$1,314,048 94	$1,340,603 25	$1,041,411 64
Loans	3,596,555 14	3,521,824 06	3,399,474 39
Interest	112,630 65	99,253 87	102,021 70
Dues repaid—installment stock	3,298,731 59	3,439,721 45	3,613,026 54
Profits repaid	1,015,428 21	1,167,889 41	1,196,118 99
Paid-up and prepaid stock	210,664 42	364,800 00	411,601 36
Salaries	194,487 00	202,923 56	201,153 72
Taxes	240,194 88	223,347 65	228,200 22
Other expenses	109,892 49	129,008 57	149,530 70
All other payments	1,594,371 57	1,030,886 59	1,381,598 41
Balance on hand	570,222 68	610,612 71	623,999 90
Totals	$12,257,227 57	$12,130,871 12	$12,348,137 57

CAPITALIZATION.

From the tabulations it appears that the total capitalization of the 151 associations is $543,100,000. This represents the par or fully paid-up value of the stock which may be issued in contradistinction from the shares actually issued and in force. The scheme contemplates continued accession to the membership for terms varying from six to eleven years, according to the par value of the shares, the periodical payments, and the rate of dividends earned and apportioned thereto.

This capitalization is represented by 4,513,500 possible shares as follows:

36 associations	3,596,000 shares of a par value of $100 each.
115 associations	917,500 shares of a par value of $200 each.

The shares issued and in force are divided as follows:

36 associations	248,990 shares of a par value of $100 each.
115 associations	161,686 shares of a par value of $200 each.

The shares pledged for loans aggregate 111,911, or 27.25 per cent of the shares in force.

PLANS OF PREMIUM AND DISTRIBUTION OF PROFITS.

In addition to the current rates of interest provided for in their by-laws, 138 associations make a charge for premium (which is in effect but another name for interest) either on the Installment or Gross plan, and some few make loans on either plan, being governed in this respect solely by the desires of the borrowers.

Of those loaning on the Gross plan, very few continue the old practice of considering this as an earned profit subject to immediate distribution, but now consider it as covering the entire life of the series and loan, dividing as a profit only the portion actually earned.

The several plans are distributed as follows:

Installment plan	84	associations.
Gross plan	29	"
Gross and installment plans	25	"
No premium	13	"

The distribution of the earned profits to shareholders is now confined to five general rules, viz.: the "Dexter," "Partnership" (including Rice's and Clark's formulas), "Wrigley," "Second Dividend," and "Third Dividend," as follows:

Dexter rule	90	associations.
Partnership rules	46	"
Wrigley rule	12	"
Third Dividend rule	2	"
Second Dividend rule	1	"

STATISTICAL INFORMATION.

From the tabulation of the reports of the 151 associations we append the following:

Number of members—Male and societies	27,292	
Female	9,488	
		37,780
Number of borrowers		12,488
Number of mortgage loans for the year		2,524
Number of stock loans for the year		1,657
Number of foreclosures since organization		1,026
Number of houses built—Report of 1897	1,122	
Report of 1898	1,192	
Report of 1899	958	
Total houses reported built since organization		12,970
Shares in force last report		403,582
Shares issued since last report		124,944
Shares matured and withdrawn since last report		117,850
Shares in force		410,676
Shares pledged for loans		111,911
Shares free		298,765
Net profits for year		$1,245,782 29
Real estate owned		$2,151,466 19
Appraised value of real estate owned		$2,032,072 00
Assessed value of real estate owned		$1,295,194 00
Reserve and undivided profits		$440,309 63

SHARES MATURED

DURING THE FISCAL TERM ENDED MAY 31, 1899.

Number of associations maturing series	42
Number of series matured	57
Number of shares matured	5,125
Dues repaid to maturing shares	$608,858 00
Profits repaid to maturing shares	$327,121 04
Average time of maturity, $200 shares, $1 00 payments	124 months
Average time of maturity, $100 shares, $1 00 payments	74⅓ months
Average time of maturity, $100 shares, $0 60 payments	105 months
Average profit, monthly compound, per series	8.94%
Average profit, monthly compound, per association	8.95%
Average profit, annual compound, $200 shares	8.90%
Average profit, annual compound, $100 shares, $1 00 payments	9.34%
Average profit, annual compound, $100 shares, $0 60 payments	10.24%

It appears from the foregoing that 5,125 shares of stock were matured within the period specified, aggregating $935,979 04 to holders, of which $327,121 04 was in the nature of profits on their investments, and that this profit shows an average rate varying from 8.90 per cent to 10.24 per cent, depending on the class of shares held and the monthly payments required.

NEW LOANS AND LOANS REPAID.

During the fiscal years represented by the several associations, the reports show that 2,524 mortgage loans and 1,657 stock loans were made to borrowers, aggregating $3,399,474 39, which is 26.41 per cent of the loans outstanding and in force.

During the same period $4,370,166 04 of loans were repaid, either by maturity of shares, foreclosure or deed of security, or by discharge in regular way before maturity, which sum is 20.71 per cent of all loans that have been in force during the year.

As compared with 1896, 1897, and 1898, the showing is:

	New Loans.	Loans Repaid.
1896	17.66%	18.16%
1897	19.41	16.50
1898	19.97	19.08
1899	26.41	20.71

INTEREST AND PREMIUMS COLLECTED.

The collections on account of interest were $1,237,176 49, and on account of premium, $371,391 38; these are respectively 7.18 per cent and 2.15 per cent of the average loans in force during the year, and compare with the same collections for 1896, 1897, 1898 as follows:

	Interest.	Premiums.	Total.
1896	6.90%	2.31%	9.21%
1897	6.93	2.30	9.23
1898	6.92	2.26	9.18
1899	7.18	2.15	9.33

NET PROFITS FOR THE YEAR.

The net profits reported by the several associations for their fiscal years aggregate the sum of $1,245,782 29, which is 7.23 per cent of the average amount of loans in force for the year; this sum is also equal to 6.75 per cent of the average capital, including the profits apportioned, and 6.14 per cent of the average total assets for the year. For the purposes of comparison we append the figures showing the rate of profits, similarly calculated, on the average loans in force as given in former reports:

1894	7.77%	1897	7.20%
1895	7.19	1898	7.28
1896	7.11	1899	7.23

SALARIES, TAXES, AND OTHER EXPENSES.

The amounts reported as paid out by these associations for salaries, taxes, and other expenses aggregate $578,884 64.

The shares reported as in force are 410,676, of which 248,990 are of a par value of $100 each and the balance are of $200 each. Reducing these to a general basis of $100 each, the cost to each share now in force appears to be:

Salaries	$0 35.11
Taxes	39.87
Other expenses	26.07
Total	$1 01.05

This expense, based on the average loans in force, would make the cost of conducting the business .03.32 per cent; based on the average capital, including profits apportioned, it would be .03.14 per cent; based on the average total assets for the year the cost would then be .02.85 per cent.

As compared with the figures for 1897 and 1898, the showing is as follows:

	Salaries.	Taxes.	Other Expenses.	Total.
1897	$0 34.10	$0 42.30	$0 19.20	$0 95.60
1898	34.80	38.30	22.20	95.30
1899	35.11	39.87	26.07	1 01.05

REAL ESTATE.

Of the 151 associations included in the present report, 35 did not appear to be possessed of any real estate at the time of making their annual reports; this left 116 associations with real estate holdings amounting to $2,151,466 19, a gain of $389,840 32 over the holdings for 1898—an average increase of $3,360 68 to each of these associations that have been compelled to assume the responsibility of taking the real estate originally pledged to secure loans made in good faith.

The present volume of real estate held presents the most unfortunate feature connected with the business. No association desires to be compelled to take the security pledged by a borrower, still they are often compelled to do so by reason of conditions beyond the control of either party to the contract; in other cases they are forced into this position because of lack of care and investigation prior to the making of the loan; in either case the chances are that depreciation and loss are the heritage of the association.

How to meet this condition with the least loss and inconvenience is what has been and is the serious question confronting each and every of these associations. The chances are that the real estate so acquired is not favorably located or is otherwise unsalable, except in times of great activity, and these conditions operate to prevent its rental at much, if any, above the taxes and insurance. In such event, if a sale is made, it must be at a sacrifice; if it is held there is an almost entire loss of income. Such is and has been the condition for the past three years. In order to protect the persistent members, as far as possible, we have compelled an annual appraisement by shareholders other than directors, and the creation of a reserve fund to meet the depreciation found to exist; though in some instances the depreciation has been immediately written off and the cost on the books made to conform to the appraised valuations; the result in either case is the same: profits that should have gone to the members have been taken to meet the depreciation.

With an improvement in business circles and a greater demand for real estate it may be possible to effect sales at rates that may return a portion or all of this loss, but whether there be an increase in values or not it is advisable that steps be taken by all to dispose of their holdings at as early a date as possible, to the end that the capital thus represented may again, perchance, be made to produce an adequate income.

ANNUAL EXAMINATIONS.

In the report of this office for 1898 this subject was treated as follows: "Most associations require that the books and accounts of the secretary be examined at least annually, either by a committee selected by the shareholders, or by a disinterested accountant, or by both. Such practice should become universal, and on such occasions the passbooks of the shareholders should be called in and thoroughly checked with the records of the secretary by such committee or accountant, and no examination should be considered complete until this has been done. Failure to conform to this rule has been the means of causing losses that might have been avoided. Errors are bound to be made, even by the most careful and conscientious, and it is better that they be located and rectified under conditions that might prove them to be clerical

errors, both of omission and commission, rather than under conditions that might place them in a far different category."

There is a tendency on the part of some associations to select auditors who are either not qualified or have not the time to properly perform the work. The question of auditing too often is not "how well" but "how cheap," consequently an effort is made to secure the services of those who will perform the work gratis.

A superficial examination made on the theory that everything is correct—a cursory glance at the footings and balances—is no audit. The only safe and satisfactory course is to select competent men, familiar with the requirements of the business, and pay them at a rate commensurate with the work and responsibility involved.

CONCLUSION.

The attention of secretaries is especially called to the requirements of Section 18, of the Act of March 23, 1893, creating this Board, and referring particularly to the preparation and filing of their annual reports. Under this section this office prescribes the form and furnishes the blanks on which such reports are to be made. In the preparation of these blanks it has been the aim to require only such information as is deemed essential in the compilation of the annual reports required to be made by this office. Every column on such blanks should be filled and every question applying to an association should be correctly answered; otherwise the report is incomplete and will be returned for correction and completion. For tabulation purposes this office considers of vital importance, questions that a secretary may sometimes think frivolous and unnecessary. Instances of this neglect are not numerous, still they do occur, and in such cases they cause delay and render necessary an amount of work that could easily be avoided.

We desire to express our appreciation of the courtesies extended, and the consideration with which the officers of the associations have cheerfully and promptly complied with our suggestions and requirements, and coöperated to bring about better conditions.

Respectfully submitted.

FRANK H. GOULD,
President,
E. D. McCABE,
Commissioners of the Building and Loan Associations.

J. L. FIELDS,
Secretary.

STATEMENT OF RECEIPTS ON ACCOUNT OF ASSESSMENT FOR EXPENSES

FOR TWELVE MONTHS ENDING MAY 31, 1899.

Name of Association.	Location.	Amount.
Alameda Building and Loan Association	Alameda	$69 94
California Building-Loan Association	Alameda	48 54
Columbian Mutual Building and Loan Association	Alameda	30 13
Encinal Building-Loan Association	Alameda	32 42
Savings, Loan and Building Association	Anaheim	12 74
Bakersfield Building and Loan Association	Bakersfield	30 81
People's Mutual Building and Loan Association	Bakersfield	19 58
Benicia Building and Loan Association	Benicia	14 72
Homestead Loan Association	Berkeley	102 52
Second Colton Building and Loan Association	Colton	10 00
Escondido Mutual Building and Loan Association	Escondido	10 00
People's Building and Loan Association	Fort Bragg	10 00
Mutual Building and Loan Association	Fort Bragg	10 00
Fortuna Building and Loan Association	Fortuna	10 00
Mutual Building and Loan Association	Fresno	39 83
Healdsburg Building and Loan Association	Healdsburg	12 40
California Mutual Building and Loan Association	Los Angeles	10 00
Columbia Building and Loan Association	Los Angeles	39 86
Equitable Building and Loan Association	Los Angeles	38 25
Fraternal Mutual Building and Loan Association	Los Angeles	13 86
Home Investment Building and Loan Association	Los Angeles	45 10
Los Angeles Building and Loan Association	Los Angeles	24 80
Metropolitan Loan Association	Los Angeles	103 27
Savings Fund and Building Society	Los Angeles	31 33
Southern California Loan Association	Los Angeles	124 28
Fidelity Savings and Loan Association	Los Angeles	11 86
State Mutual Building and Loan Association	Los Angeles	313 02
Union Mutual Building and Loan Association	Los Angeles	101 92
Mechanics Savings Mutual Building & Loan Ass'n	Los Angeles	16 51
Provident Mutual Building and Loan Association	Los Angeles	201 89
Protective Savings Mutual Building & Loan Ass'n	Los Angeles	124 77
Borrowers Mutual Building & Loan Association	Los Angeles	10 00
State of California Mutual Building & Loan Ass'n	Los Angeles	20 05
Los Gatos Building and Loan Association	Los Gatos	10 00
Merced Mutual Building and Loan Association	Merced	13 83
Modesto Building and Loan Association	Modesto	10 00
Napa Building and Loan Association	Napa	26 24
Newcastle Building and Loan Association	Newcastle	10 00
Equity Building and Loan Association	Oakland	10 58
Home Security Building and Loan Association	Oakland	89 18
People's Building and Loan Association	Oakland	16 73
Standard Building and Loan Association	Oakland	13 24
Brooklyn Investment and Loan Association	East Oakland	33 24
Cosmopolitan Mutual Building and Loan Ass'n	East Oakland	48 68
Oakland Building and Loan Association	East Oakland	24 13
West Oakland Building and Loan Association	West Oakland	29 68
People's Mutual Building and Loan Association	Ontario	20 23

STATEMENT OF RECEIPTS—Continued.

Name of Association.	Location.	Amount.
Orange Building and Loan Association	Orange	$20 13
Palo Alto Building and Loan Association	Palo Alto	14 54
Mutual Building and Loan Association	Pasadena	22 83
Petaluma Mutual Loan Association	Petaluma	16 70
Pleasanton Mutual Building & Loan Association	Pleasanton	10 00
Mutual Building and Loan Association	Pomona	17 16
San Mateo County Building and Loan Association	Redwood City	67 16
Germania Building and Loan Association	Sacramento	134 19
Occidental Building and Loan Association	Sacramento	10 00
Sacramento Building and Loan Association	Sacramento	60 04
Salinas Mutual Building and Loan Association	Salinas	12 59
Santa Fe Building and Loan Association	San Bernardino	38 53
San Diego Building and Loan Association	San Diego	111 62
San Diego Savings and Loan Association	San Diego	10 00
Silver Gate Building and Loan Association	San Diego	12 48
Acme Building and Loan Association	San Francisco	16 49
Ætna Mutual Building and Loan Association	San Francisco	22 80
Alliance Building and Loan Association	San Francisco	15 32
Atlas Building and Loan Association	San Francisco	28 19
Alta Building and Loan Association	San Francisco	10 00
Argonaut Building and Loan Association	San Francisco	20 49
Bay City Building and Loan Association	San Francisco	22 23
California Mut. S. F. L. and B. Association	San Francisco	22 03
Capital Building and Loan Association	San Francisco	22 00
City Building and Loan Association	San Francisco	26 43
Citizens Building and Loan Association	San Francisco	231 66
Columbia Building and Loan Association	San Francisco	13 65
Commercial Building and Loan Association	San Francisco	35 10
Commonwealth Mutual Building and Loan Ass'n	San Francisco	10 00
Cosmos Loan Association	San Francisco	11 95
Economy Building and Loan Association	San Francisco	21 55
Eintracht Spar und Bau Verein	San Francisco	23 84
El Dorado Loan Association	San Francisco	21 19
Empire Building and Loan Association	San Francisco	30 00
Eureka Loan Association	San Francisco	12 69
Eureka Building and Loan Association	San Francisco	23 78
Excelsior Loan Association	San Francisco	49 66
Fairmount Loan Association	San Francisco	32 03
Fidelity Building and Loan Association	San Francisco	47 55
Franklin Savings and Building Association	San Francisco	39 26
Germania Building and Loan Association	San Francisco	101 12
Golden Gate Mutual Building and Loan Ass'n	San Francisco	15 70
Golden Rule Building and Loan Association	San Francisco	26 24
Golden West Building and Loan Association	San Francisco	14 13
Granite Mutual Building and Loan Association	San Francisco	19 68
Guardian Loan Association	San Francisco	10 00
Home Investment Association	San Francisco	21 97
Home Mutual Building and Loan Association	San Francisco	60 53
Homeseekers Loan Association	San Francisco	27 63
Householders Building and Loan Association	San Francisco	11 73
Humboldt Building and Loan Association	San Francisco	66 95
Inter-Nos Building and Loan Association	San Francisco	54 34
Italian-Swiss Mutual Loan Association	San Francisco	71 03
Mechanics Building and Loan Association	San Francisco	26 96
Merchants Loan Association	San Francisco	16 64
Mission Home and Loan Association	San Francisco	47 58

STATEMENT OF RECEIPTS—Continued.

Name of Association.	Location.	Amount.
Monarch Mutual Building and Loan Association	San Francisco	$26 13
Mutual Savings Fund Loan and Building Ass'n	San Francisco	56 89
National Home and Loan Association	San Francisco	25 51
Occidental Loan Association	San Francisco	33 75
Pacific Coast Loan Association	San Francisco	21 55
Pacific Loan Association	San Francisco	47 09
Pacific Mutual Building and Loan Association	San Francisco	27 09
Provident Mutual Loan Association	San Francisco	42 45
Prudence Building and Loan Association	San Francisco	32 13
Safety Mutual Building and Loan Association	San Francisco	43 70
San Francisco Mutual Loan Association	San Francisco	38 80
San Francisco and Oakland Mutual Loan Ass'n	San Francisco	74 88
San Francisco Home Mutual Loan Association	San Francisco	28 42
Security Loan Association	San Francisco	13 18
Triumph Loan Association	San Francisco	31 93
Union Loan Association	San Francisco	25 66
Western Loan Association	San Francisco	33 62
Yerba Buena Mutual Building and Loan Ass'n	San Francisco	10 00
California Home Building and Loan Association	San Francisco	10 00
California Guarantee Investment Company	San Francisco	43 21
Continental Building and Loan Association	San Francisco	953 26
Pacific Coast Savings Society	San Francisco	246 27
Pacific States Savings, Loan, and Building Co.	San Francisco	523 80
Rentors Coöperative Investment Company	San Francisco	273 16
Progress Mutual Building and Loan Association	San Francisco	28 08
Borrowers Mutual Building and Loan Association	San Francisco	10 00
Richmond Mutual Building and Loan Association	San Francisco	13 16
Globe Mutual Building and Loan Association	San Francisco	24 05
Mutual Building and Loan Association	San José	50 00
Nucleus Building and Loan Association	San José	21 63
San José Building and Loan Association	San José	58 40
San Luis Building and Loan Association	San Luis Obispo	40 27
San Mateo Mutual Building and Loan Association	San Mateo	15 08
Marin County Mutual Building and Loan Ass'n	San Rafael	60 43
Home Mutual Building and Loan Association	Santa Ana	42 39
Loan and Building Association	Santa Barbara	65 90
Santa Clara Building and Loan Association	Santa Clara	30 00
Santa Paula Building and Loan Association	Santa Paula	18 49
Santa Rosa Building and Loan Association	Santa Rosa	43 10
Sausalito Mutual Loan Association	Sausalito	12 38
Tamalpais Mutual Building and Loan Association	Sausalito	10 00
San Joaquin Valley Building and Loan Ass'n	Stockton	41 50
Stockton Land, Loan, and Building Company	Stockton	110 06
Tulare Building and Loan Association	Tulare	18 38
Ukiah Mutual Building and Loan Association	Ukiah	18 12
Ventura Mutual Building and Loan Association	Ventura	13 72
Visalia Building and Loan Association	Visalia	18 20
Watsonville Mutual Building and Loan Ass'n	Watsonville	16 72
Woodland Building and Loan Association	Woodland	10 00
Total assessment for 1899		$7,462 79
Surplus and unexpended balances from last report		291 31

STATEMENT OF RECEIPTS—Continued.

New Licenses Issued.

Name of Association.	Location.	Amount.
West Shore Mutual	San Francisco	$10 00
Los Angeles County Mutual	Pasadena	10 00
Fullerton Mutual	Fullerton	9 00
Covina Mutual	Covina	8 00
Total		$7,791 10

Appropriation.

Salaries of Commissioners	$4,800 00	
Salary of Secretary	1,200 00	
Traveling expenses	700 00	
Office expenses	400 00	
Office rent	480 00	
		$7,580 00
Balance to next report		$211 10

STATE OF CALIFORNIA,
CITY AND COUNTY OF SAN FRANCISCO. } ss.

J. L. Fields, being first duly sworn, deposes and says that he is Secretary of the Board of Building and Loan Commissioners and that the foregoing statement is correct.

J. L. FIELDS.

Subscribed and sworn to before me, this 29th day of September, 1899.

FRANK H. GOULD,
Commissioner of Building and Loan Associations.

REPORTS

OF

BUILDING AND LOAN ASSOCIATIONS.

ALPHABETICALLY ARRANGED BY CITIES AND TOWNS.

2B&L

REPORTS OF BUILDING AND LOAN ASSOCIATIONS.

No. 1—ALAMEDA.

ALAMEDA BUILDING AND LOAN ASSOCIATION.

(Incorporated March 7, 1876.)

CHAS. K. CLARK, Secretary. C. C. VOLBERG, President.

Fiscal year ends March 31, 1899.

No. of series, 24. No. of shares, 2,768½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$174,110 00	Installment stock—dues	$142,089 00
Arrearages		8,027 35	Earnings apportioned	51,950 19
On shares	$2,955 50		Advance payments	285 00
On interest	3,262 20		Overdrafts and bills payable	8,419 15
On premiums	1,305 70		Reserve and undivided profits	7,240 05
On fines, etc.	403 95		Other liabilities	11,941 85
Real estate owned		39,175 19		
Other assets		612 70		
Total assets		$221,925 24	Total liabilities	$221,925 24

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$32,085 50	Overdrafts and bills payable	$3,694 94
Interest received	13,310 31	Loans on mortgages and stock	37,013 20
Premiums received	4,604 05	Interest paid	978 73
Fines received	254 50	Dues repaid — installment stock	36,214 00
Fees received	38 55	Profits repaid — installment stock	17,116 50
Loans repaid	66,949 20	Salaries	1,200 00
Overdrafts and bills payable	8,419 15	Taxes	3,505 32
All other receipts	21,561 00	Other expenses	828 44
		All other disbursements	46,671 13
Total receipts	$147,222 26	Total disbursements	$147,222 26

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
26	62	56	$126 00	$200 00	$200 00
27	162	134	120 00	192 45	175 05
28	106	95	114 00	178 29	175 05
29	98	90	108 00	164 75	161 90
30	96	96	102 00	151 78	149 25
31	97	64	96 00	139 38	135 05
32	126	118	90 00	127 50	121 90
33	81	79	84 00	116 14	109 75
34	45	40	78 00	105 26	98 45
35	89	89	72 00	94 86	80 00
36	110	110	66 00	84 90	78 30
37	143	112	60 00	75 38	69 25
38	47	26	54 00	66 26	61 40
39	168	137	48 00	57 54	53 80
40	262	236	42 00	49 19	46 50
41	190	151	36 00	41 21	39 30
42	165	121	30 00	33 56	32 30
43	328	277	24 00	26 25	25 50
44	318	275	18 00	19 24	18 80
45		154	12 00	12 55	12 40
46		166	6 00	6 13	6 00
47		52	3 00	3 06	3 00
48		56½	2 00	2 04	2 00
49		34	1 00	1 02	1 00

No. 2—ALAMEDA.

CALIFORNIA BUILDING-LOAN ASSOCIATION.

(Incorporated February, 1888.)

CHAS. E. NAYLOR, Secretary. GEO. E. PLUMMER, President.

Fiscal year ends February 28, 1899.

No. of series, 14. No. of shares, 1,810.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$156,970 00	Installment stock—dues	$99,834 00
Arrearages		4,169 10	Earnings apportioned	40,658 22
On shares	$1,653 00		Advance payments	893 00
On interest	2,096 40		Overdrafts and bills payable	27,611 10
On premiums	276 50		Reserve and undivided profits	1,053 66
On fines, etc.	143 20		Unearned premiums	2,657 00
Cash on hand and in bank		3,917 73	Other liabilities	728 00
Real estate owned		8,200 00		
Other assets		178 15		
Total assets		$173,434 98	Total liabilities	$173,434 98

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$762 99	Overdrafts and bills payable	$23,722 81
Installment stock—dues	23,939 00	Loans on mortgages and stock	18,650 00
Interest received	11,857 81	Interest paid	1,456 97
Premiums received	1,654 95	Dues repaid — installment stock	28,972 00
Fines received	204 10	Profits repaid — installment stock	11,926 96
Fees received	51 20	Salaries	1,761 00
Loans repaid	24,400 00	Taxes	2,023 82
Overdrafts and bills payable	27,611 10	Other expenses	489 02
All other receipts	5,070 00	All other disbursements	2,630 84
		Balance on hand and in bank	3,917 73
Total receipts	$95,551 15	Total disbursements	$95,551 15

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	205	195	$120 00	$192 00	$192 00
3	93	65	108 00	166 32	166 32
4	297	265	96 00	142 08	137 47
5	96	75	84 00	119 28	112 22
6	21	21	72 00	97 92	90 14
7	173	140	60 00	78 00	70 80
8	277	227	48 00	59 52	53 56
9	51	51	42 00	50 82	46 41
10	194	154	36 00	42 48	39 24
11	49	49	30 00	34 50	32 25
12	209	119	24 00	26 88	25 44
13	88	13	18 00	19 62	18 81
14		334	12 00	12 72	12 36
15		102	6 00	6 18	6 09

No. 3—ALAMEDA.

COLUMBIAN MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated July 18, 1893.)

H. K. STARKWEATHER, Secretary. GEO. A. BORDWELL, President.

Fiscal year ends July 30, 1898.

No. of series, 13. No. of shares, 1,153.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$43,775 82	Installment stock—dues	$39,672 00
Arrearages		528 50	Earnings apportioned	6,354 11
On shares	$197 00		Advance payments	2,669 85
On interest	270 60		Reserve and undivided profits	937 52
On premiums	40 40		Other liabilities	3,456 85
On fines, etc.	20 50			
Cash on hand and in bank		513 97		
Real estate owned		7,659 44		
Other assets		612 60		
Total assets		$53,090 33	Total liabilities	$53,090 33

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$44 35	Overdrafts and bills payable	$2,135 88
Installment stock—dues	14,559 05	Loans on mortgages and stock	17,675 00
Interest received	3,548 59	Dues repaid — installment stock	4,630 00
Premiums received	998 05	Profits repaid—installment stock	772 61
Fines received	94 60	Salaries	600 00
Fees received	20 50	Taxes	664 21
Loans repaid	12,633 24	Other expenses	225 75
All other receipts	3,243 84	All other disbursements	7,924 80
		Balance on hand and in bank	513 97
Total receipts	$35,142 22	Total disbursements	$35,142 22

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	215	200	$60 00	$74 24	$68 54
2	65	65	54 00	65 10	61 09
3	80	73	48 00	55 98	53 76
4	169	153	42 00	48 12	46 41
5	171	137	36 00	40 27	39 24
6	126	96	30 00	32 96	32 25
7	173	132	24 00	25 89	25 44
8	105	89	18 00	19 07	18 81
9	23	23	15 00	15 72	15 56
10		14	12 00	12 47	12 36
11		81	9 00	9 27	9 00
12		46	6 00	6 12	6 00
13		44	3 00	3 03	3 00

No. 4—ALAMEDA.

ENCINAL BUILDING-LOAN ASSOCIATION.

(Incorporated December 28, 1888.)

E. MINOR SMITH, Secretary. JOSEPH F. FORDERER, President.

Fiscal year ends December 31, 1898.

No. of series, 19. No. of shares, 1,247.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$88,543 57	Installment stock—dues	$81,786 00
Arrearages		6,336 45	Earnings apportioned	29,399 71
On shares	$2,266 00		Advance payments	415 00
On interest	2,964 45		Overdrafts and bills payable	4,000 00
On premiums	1,106 00		Reserve and undivided profits	1,935 45
Cash on hand and in bank		939 78	Unearned premiums	264 00
Real estate owned		20,468 39		
Other assets		1,511 97		
Total assets		$117,800 16	Total liabilities	$117,800 16

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$16,335 00	Overdrafts and bills payable	$12,987 92
Interest received	8,064 65	Loans on mortgages and stock	5,509 96
Premiums received	2,268 32	Interest paid	905 09
Fines received	157 00	Dues repaid — installment stock	26,625 00
Fees received	16 50	Profits repaid — installment stock	10,659 76
Loans repaid	31,440 00	Salaries	942 00
Overdrafts and bills payable	4,000 00	Taxes	1,627 73
All other receipts	1,648 38	Other expenses	471 70
		All other disbursements	3,260 91
		Balance on hand and in bank	939 78
Total receipts	$63,929 85	Total disbursements	$63,929 85

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	197	110	$120 00	$191 43	$190 43
2	162	97	108 00	161 40	159 40
3	81	67	102 00	147 76	144 76
4	93	58	96 00	135 24	131 24
5	71	57	90 00	123 26	118 26
6	82	82	84 00	111 95	105 95
7	82	82	78 00	101 25	93 40
8	92	87	72 00	91 18	85 14
9	21	21	66 00	81 62	76 05
10	55	50	60 00	72 54	69 15
11	195	136	54 00	63 87	61 29
12	51	43	48 00	55 71	53 88
13	20	20	42 00	47 82	46 51
14	82	60	36 00	40 19	39 32
15	35	25	30 00	32 89	32 32
16	51	51	24 00	25 83	25 50
17	56	56	18 00	19 02	18 85
18		64	12 00	12 45	12 38
19		81	6 00	6 12	6 10

No. 5—ANAHEIM.

SAVINGS AND LOAN ASSOCIATION.

(Incorporated January 8, 1889.)

H. W. CHYNOWETH, Secretary. H. A. McWILLIAMS, Vice-President.

Fiscal year ends April 30, 1899.

No. of series, 10. No. of shares, 985.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$30,209 84	Installment stock—dues	$29,442 00
Arrearages		1,283 06	Earnings apportioned	9,488 16
On shares	$510 25		Advance payments	55 91
On interest	651 20		Reserve and undivided profits	686 50
On fines, etc.	121 60			
Cash on hand and in bank		8,179 67		
Total assets		$39,672 57	Total liabilities	$39,672 57

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$6,919 56	Loans on mortgages and stock	$6,835 00
Installment stock—dues	5,886 75	Dues repaid — installment stock	2,472 00
Interest received	2,167 40	Profits repaid — installment stock	628 30
Premiums received	456 40	Salaries	271 50
Fines received	37 40	Other expenses	79 19
Fees received	6 00	All other disbursements	17 50
Loans repaid	3,000 00	Balance on hand and in bank	8,179 67
All other receipts	9 65		
Total receipts	$18,483 16	Total disbursements	$18,483 16

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	128	123	$60 00	$92 09	$92 09
2	29	29	54 00	79 21	79 21
3	89	65	48 00	66 40	66 40
4	69	64	42 00	55 56	55 56
5	117	111	36 00	45 62	45 62
6	142	130	30 00	36 45	36 45
7	112	102	24 00	28 05	28 05
8	122	114	18 00	20 28	20 28
9	170	135	12 00	13 02	13 02
10	------------	112	6 00	6 26	6 26

No. 6—BAKERSFIELD.

BAKERSFIELD BUILDING AND LOAN ASSOCIATION.

(Incorporated May 14, 1890.)

GEORGE W. PRICE, Secretary. A. WEILL, Vice-President.

Fiscal year ends May 31, 1899.

No. of series, 9. No. of shares, 1,132.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$145,350 00	Installment stock—dues	$94,512 00
Arrearages		5,502 47	Earnings apportioned	62,499 23
On shares	$2,015 00		Advance payments	1 00
On interest	2,987 25		Overdrafts and bills payable	22,000 00
On fines, etc.	500 22		Reserve and undivided profits	4,003 62
Cash on hand and in bank		10,101 15	Unearned premiums	1,278 81
Real estate owned		19,959 58		
Other assets		3,381 46		
Total assets		$184,294 66	Total liabilities	$184,294 66

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$15,544 96	Overdrafts and bills payable	$18,000 00
Installment stock—dues	15,586 00	Loans on mortgages and stock	2,600 00
Interest received	15,811 65	Interest paid	2,715 59
Fines received	649 95	Dues repaid — installment stock	53,726 00
Fees received	13 40	Profits repaid — installment stock	34,064 00
Loans repaid	57,000 00	Salaries	600 00
Overdrafts and bills payable	20,000 00	Taxes	2,036 44
All other receipts	8,509 34	Other expenses	355 91
		All other disbursements	8,916 21
		Balance on hand and in bank	10,101 15
Total receipts	$133,115 30	Total disbursements	$133,115 30

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	827	425	$108 00	$200 00	$200 00
2	232	190	96 00	158 89	150 00
3	196	121	84 00	126 13	120 00
4	153	123	72 00	100 06	92 00
5	102	74	60 00	78 24	73 00
6	108	98	48 00	59 52	55 00
7	75	35	36 00	42 98	39 00
8	13	13	24 00	28 03	25 00
9	------	53	12 00	14 37	12 50

No. 7—BAKERSFIELD.

PEOPLE'S MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated January 27, 1892.)

F. W. ROBINSON, Secretary. WM. S. TEVIS, President.

Fiscal year ends January 20, 1899.

No. of series, 7. No. of shares, 1,507½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$70,940 00	Installment stock—dues	$43,945 20
Arrearages		82 11	Earnings apportioned	23,344 00
On shares	$23 40		Overdrafts and bills payable	1,685 68
On interest	19 50		Reserve and undivided profits	1,002 86
On premiums	23 40		Other liabilities	1,486 06
On fines, etc.	15 81			
Real estate owned		400 00		
Other assets		41 69		
Total assets		$71,463 80	Total liabilities	$71,463 80

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$15,405 92	Loans on mortgages and stock	$28,190 00
Installment stock—dues	11,773 20	Dues repaid — installment stock	18,789 00
Interest received	3,883 91	Profits repaid — installment stock	8,844 91
Premiums received	4,135 82	Salaries	660 00
Fines received	129 93	Taxes	903 58
Fees received	61 90	Other expenses	193 03
Loans repaid	20,400 00	All other disbursements	118 80
Overdrafts and bills payable	1,685 68		
All other receipts	222 96		
Total receipts	$57,699 32	Total disbursements	$57,699 32

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	590	378	$50 40	$87 80	$87 00
2	332	185	43 20	69 28	65 25
3	97	47	36 00	53 16	48 50
4	135	121	28 80	39 22	35 00
5	385	291	21 60	27 10	24 35
6	291	270	14 40	16 63	15 60
7	------------	215½	7 20	7 72	7 45

No. 8—BENICIA.

BENICIA BUILDING AND LOAN ASSOCIATION.

(Incorporated January 11, 1883.)

A. Robinson, Secretary. Charles Stewart, President.

Fiscal year ends January 31, 1899.

No. of series, 10. No. of shares, 546.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$36,730 00	Installment stock—dues	$18,534 00
Arrearages		679 90	Earnings apportioned	4,355 66
On shares	$533 00		Advance payments	257 15
On interest	46 90		Overdrafts and bills payable	2,411 54
Other assets		253 21	Reserve and undivided profits	299 05
			Unearned premiums	4,895 24
			Other liabilities	6,910 47
Total assets		$37,663 11	Total liabilities	$37,663 11

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,088 12	Loans on mortgages and stock	$18,500 00
Installment stock—dues	7,730 00	Interest paid	26 65
Interest received	3,536 10	Dues repaid — installment stock	15,716 00
Premiums received	3,700 00	Profits repaid — installment stock	5,912 87
Fines received	23 50	Salaries	720 00
Fees received	19 30	Taxes	521 21
Loans repaid	22,796 00	All other disbursements	1,039 45
Overdrafts and bills payable	2,411 54		
All other receipts	1,131 62		
Total receipts	$42,436 18	Total disbursements	$42,436 18

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
7	105	55	$120 00	$171 23	$168 67
9	27	17	96 00	125 01	122 11
10	25	15	84 00	106 14	101 74
11	45	30	48 00	54 45	50 58
12	71	52	36 00	39 72	37 11
13	73	66	30 00	32 52	30 36
14	38	18	24 00	25 58	24 18
15	57	63	18 00	18 94	18 00
16		134	12 00	12 45	12 00
17		96	6 00	6 12	6 00

No. 9—BERKELEY.

HOMESTEAD LOAN ASSOCIATION.

(Incorporated March 3, 1886.)

CHAS. K. CLARK, Secretary. M. M. RHORER, President.

Fiscal year ends March 31, 1899.

No. of series, 19. No. of shares, 3,823.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$213,433 30	Installment stock—dues	$170,232 00
Arrearages		4,753 85	Earnings apportioned	58,598 60
On shares	$1,826 00		Advance payments	1,065 00
On interest	1,869 30		Reserve and undivided profits	4,150 32
On premiums	888 25		Other liabilities	1,068 45
On fines, etc.	170 30			
Cash on hand and in bank		3,220 22		
Real estate owned		10,263 45		
Other assets		3,443 55		
Total assets		$235,114 37	Total liabilities	$235,114 37

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,136 17	Loans on mortgages and stock	$22,828 35
Installment stock—dues	46,831 00	Interest paid	115 14
Interest received	17,096 90	Dues repaid — installment stock	53,475 00
Premiums received	6,687 75	Profits repaid — installment stock	30,054 35
Fines received	340 20	Salaries	1,800 00
Fees received	54 75	Taxes	4,813 74
Loans repaid	56,065 00	Other expenses	523 62
All other receipts	2,762 15	All other disbursements	14,143 50
		Balance on hand and in bank	3,220 22
Total receipts	$130,973 92	Total disbursements	$130,973 92

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
8	106	66	$114 00	$187 82	$183 40
9	161	97	108 00	173 02	168 45
10	159	149	102 00	158 92	154 35
11	111	103	96 00	145 50	141 05
12	122	105	90 00	132 71	128 45
13	199	196	84 00	120 53	116 50
14	170	142	78 00	108 93	105 25
15	126	117	72 00	97 89	94 55
16	89	83	66 00	87 37	84 40
17	213	200	60 00	77 35	74 75
18	82	82	54 00	67 81	65 04
19	167	161	48 00	58 72	56 55
20	296	276	42 00	50 07	47 65
21	305	274	36 00	41 83	40 05
22	351	285	30 00	33 98	32 35
23	447	409	24 00	26 50	25 50
24	288	249	18 00	19 39	18 70
25	----------	470	12 00	12 61	12 30
26	----------	359	6 00	6 15	6 07

No. 10—COLTON.

SECOND COLTON BUILDING AND LOAN ASSOCIATION.

(Incorporated January 1, 1888.)

GEORGE M. HUBBARD, Secretary. W. W. WILCOX, President.

Fiscal year ends December 31, 1898.

No. of series, 6. No. of shares, 237.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$20,000 00	Installment stock—dues	$21,991 00
Arrearages		4,586 00	Earnings apportioned	10,586 74
On shares	$1,822 00		Other liabilities	810 72
On interest	2,764 00			
Cash on hand and in bank		1,666 00		
Real estate owned		6,828 96		
Other assets		307 50		
Total assets		$33,388 46	Total liabilities	$33,388 46

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,005 21	Dues repaid — installment stock	$8,661 00
Installment stock—dues	2,512 00	Profits repaid — installment stock	4,795 31
Interest received	3,068 00	Salaries	300 00
Loans repaid	10,000 00	Taxes	353 48
All other receipts	1,484 10	Other expenses	142 56
		All other disbursements	2,150 96
		Balance on hand and in bank	1,666 00
Total receipts	$18,069 31	Total disbursements	$18,069 31

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	128	81	$120 00	$201 75	$201 75
2	41	41	105 00	152 29	145 00
3	78	51	88 00	115 62	105 00
4	43	34	72 00	87 31	80 00
5	11	8	60 00	68 57	60 00
6	24	22	25 00	26 29	25 00

No. 11—ESCONDIDO.

ESCONDIDO MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated September 9, 1893.)

S. L. SHOTWELL, Secretary. W. H. BALDRIDGE, President.

Fiscal year ends September 24, 1898.

No. of series, 10. No. of shares, 302.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$10,100 00	Installment stock—dues	$9,192 00
Cash on hand and in bank	1,798 59	Paid-up and prepaid stock	200 00
Other assets	80 00	Earnings apportioned	2,538 54
		Advance payments	24 20
		Reserve and undivided profits	23 85
Total assets	$11,978 59	Total liabilities	$11,978 59

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$47 28	Overdrafts and bills payable	$300 00
Installment stock—dues	3,822 00	Loans on mortgages and stock	2,100 00
Interest received	778 74	Interest paid	14 50
Premiums received	504 39	Dues repaid—installment stock	1,394 00
Fines received	15 40	Profits repaid—installment stock	209 93
Fees received	1 20	Salaries	120 00
Loans repaid	700 00	Taxes	159 53
Overdrafts and bills payable	300 00	Other expenses	13 50
All other receipts	21 04	All other disbursements	80 00
		Balance on hand and in bank	1,798 59
Total receipts	$6,190 05	Total disbursements	$6,190 05

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	33	25	$60 00	$86 34	$79 75
2	26	25	54 00	73 81	68 86
3	38	33	48 00	63 16	59 34
4	26	21	42 00	53 55	50 66
5	37	32	36 00	44 41	42 31
6	17	12	30 00	35 70	34 27
7	46	39	24 00	27 46	26 60
8	31	31	18 00	19 77	18 76
9	----------	65	12 00	12 72	12 33
10	----------	15	6 00	6 16	6 00
Prepaid	4	4	50 00	66 47	62 35

No. 12—FORT BRAGG.

PEOPLE'S BUILDING AND LOAN ASSOCIATION.

(Incorporated October 14, 1889.)

JNO. E. WELLER, Secretary. ERI HUGGINS, President.

Fiscal year ends October 31, 1898.

No. of series, 6. No. of shares, 303½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$48,723 70	Installment stock—dues	$23,496 00
Arrearages		301 00	Earnings apportioned	14,357 73
On shares	$212 50		Advance payments	29 50
On interest	88 50		Reserve and undivided profits	10 71
Cash on hand and in bank		474 25	Unearned premiums	3,570 66
Real estate owned		1,506 77	Other liabilities	11,070 45
Other assets		1,529 33		
Total assets		$52,535 05	Total liabilities	$52,535 05

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,053 27	Loans on mortgages and stock	$10,123 70
Installment stock—dues	5,934 75	Dues repaid—installment stock	23,958 00
Interest received	3,798 21	Profits repaid—installment stock	20,603 02
Premiums received	1,246 00	Salaries	300 00
Fines received	25 85	Taxes	609 29
Fees received	3 00	Other expenses	105 22
Loans repaid	29,870 00	All other disbursements	9,335 23
All other receipts	23,577 63	Balance on hand and in bank	474 25
Total receipts	$65,508 71	Total disbursements	$65,508 71

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	148½	148½	$96 00	$165 00	$127 92
3	49	43	84 00	131 07	107 88
4	64	61	72 00	102 64	89 04
5	10	10	60 00	78 43	71 40
8	12	12	24 00	25 76	25 20
9		29	12 00	12 44	12 36

No. 13—FORT BRAGG.

MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated February 7, 1894.)

W. J. SURRYHM, Secretary. C. W. MATHEWS, President.

Fiscal year ends January 28, 1899.

No. of series, 8. No. of shares, 82.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$8,500 00	Installment stock—dues	$4,392 00
Arrearages		512 25	Earnings apportioned	2,385 44
On shares	$294 50		Advance payments	100 80
On interest	217 75		Reserve and undivided profits	1 05
Cash on hand and in bank		87 57	Unearned premiums	2,238 89
Real estate owned		916 97	Other liabilities	960 91
Other assets		62 30		
Total assets		$10,079 09	Total liabilities	$10,079 09

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$316 82	Loans on mortgages and stock	$800 00
Installment stock—dues	606 00	Dues repaid — installment stock	66 00
Interest received	443 35	Profits repaid—installment stock	5 03
Premiums received	320 00	Salaries	120 00
Fines received	27 80	Taxes	82 77
Fees received	65	Other expenses	11 35
All other receipts	209 93	All other disbursements	751 83
		Balance on hand and in bank	87 57
Total receipts	$1,924 55	Total disbursements	$1,924 55

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	56	56	$60 00	$95 24	$71 40
2	8	8	54 00	80 98	63 18
3	3	3	48 00	68 26	54 96
4	5	5	42 00	57 42	47 34
5	7	5	36 00	46 38	39 72
7	1	1	24 00	27 96	25 56
9		3	12 00	12 68	12 36
10		1	6 00	6 38	6 13

No. 14—FORTUNA.

FORTUNA BUILDING AND LOAN ASSOCIATION.

(Incorporated April 30, 1889.)

W. P. McIntyre, Secretary. M. Chidester, Vice-President.

Fiscal year ends May 31, 1899.

No. of series, 11. No. of shares, 291.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$13,110 00	Installment stock—dues	$9,522 00
Arrearages		639 25	Earnings apportioned	2,153 05
On shares	$391 00		Advance payments	14 00
On interest	202 30		Overdrafts and bills payable	400 00
On fines, etc.	45 95		Reserve and undivided profits	44 26
Cash on hand and in bank		823 71	Other liabilities	2,443 45
Other assets		3 80		
Total assets		$14,576 76	Total liabilities	$14,576 76

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1 60	Overdrafts and bills payable	$700 00
Installment stock—dues	3,778 00	Loans on mortgages and stock	2,990 00
Interest received	809 00	Interest paid	154 50
Premiums received	528 00	Dues repaid — installment stock	4,242 00
Fines received	71 25	Profits repaid — installment stock	1,423 20
Fees received	15 80	Salaries	120 00
Loans repaid	4,305 00	Taxes	128 61
Overdrafts and bills payable	500 00	Other expenses	48 45
All other receipts	623 85	All other disbursements	2 03
		Balance on hand and in bank	823 71
Total receipts	$10,632 50	Total disbursements	$10,632 50

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
8	28	23	$72 00	$99 00	$99 00
9	4				
10	20	18	60 00	79 20	76 00
11	30	25	54 00	69 56	66 97
12	12	10	48 00	59 96	55 97
13	39	39	42 00	50 67	47 78
14	17	17	36 00	41 63	38 81
15	31	31	30 00	33 89	31 94
16	18	18	24 00	26 46	24 82
17	43	41	18 00	19 35	18 45
18		32	12 00	12 57	12 10
19		37	6 00	6 15	6 00

No. 15—FRESNO.

MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated March 17, 1892.)

A. V. LISENBY, Secretary. ALEXANDER GORDON, President.

Fiscal year ends March 1, 1899.

No. of series, 14. No. of shares, 1,614.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$127,170 00	Installment stock—dues	$99,328 00
Arrearages		558 75	Earnings apportioned	38,912 19
On shares	$225 00		Reserve and undivided profits	3,463 54
On interest	333 75		Other liabilities	488 74
Cash on hand and in bank		9,120 09		
Real estate owned		4,893 63		
Other assets		450 00		
Total assets		$142,192 47	Total liabilities	$142,192 47

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,136 19	Loans on mortgages and stock	$9,300 00
Installment stock—dues	19,924 00	Dues repaid — installment stock	11,805 00
Interest received	10,876 14	Profits repaid — installment stock	4,061 25
Premiums received	1,395 00	Salaries	822 50
Fines received	52 30	Taxes	2,385 06
Fees received	2 50	Other expenses	152 95
Loans repaid	4,180 00	All other disbursements	744 28
All other receipts	825 00	Balance on hand and in bank	9,120 09
Total receipts	$38,391 13	Total disbursements	$38,391 13

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	901	776	$84 00	$122 98	$118 00
2	57	57	78 00	111 89	102 00
3	112	109	72 00	98 54	88 00
4	23	20	64 00	83 75	75 00
5	52	52	60 00	76 62	68 00
6	63	63	55 00	68 07	61 00
7	93	62	48 00	57 41	53 00
8	49	49	41 00	47 54	45 00
9	86	75	36 00	41 16	39 00
10	38	38	30 00	32 95	31 50
11	107	97	24 00	26 21	24 75
12	95	85	18 00	19 07	18 50
13	----------	86	12 00	12 45	12 00
14	----------	45	6 00	6 12	6 00

No. 16—HEALDSBURG.

HEALDSBURG MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated December 31, 1894.)

J. R. MILLER, Secretary. JOHN FAVOUR, President.

Fiscal year ends December 31, 1898.

No. of series, 8. No. of shares, 954.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$25,200 00	Installment stock—dues	$19,581 00
Cash on hand and in bank	264 19	Earnings apportioned	3,854 08
Other assets	85 40	Advance payments	50 20
		Overdrafts and bills payable	1,830 00
		Reserve and undivided profits	19
		Other liabilities	234 12
Total assets	$25,549 59	Total liabilities	$25,549 59

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$5,853 00	Overdrafts and bills payable	$2,864 87
Interest received	1,447 50	Loans on mortgages and stock	5,550 00
Premiums received	1,158 00	Interest paid	287 09
Fines received	28 80	Dues repaid — installment stock	1,265 00
Fees received	22 80	Profits repaid — installment stock	123 97
Loans repaid	2,300 00	Salaries	180 00
All other receipts	181 77	Taxes	357 85
		Other expenses	41 90
		All other disbursements	57 00
		Balance on hand and in bank	264 19
Total receipts	$10,991 87	Total disbursements	$10,991 87

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	656	611	$24 00	$29 10	$27 06
2	133	123	21 00	24 87	23 32
3	62	57	18 00	20 68	19 34
4	19	19	15 00	16 84	15 92
5	40	40	12 00	13 15	12 34
6	23	23	9 00	9 65	9 19
7	------	31	6 00	6 30	6 00
8	------	50	3 00	3 08	3 00

No. 17—LOS ANGELES.

CALIFORNIA MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated August 11, 1891.)

FRED A. WALTON, Secretary. A. C. JONES, President.

Fiscal year ends August 18, 1898.

No. of series, 6. No. of shares, 381.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$31,891 66	Installment stock—dues	$27,982 00
Arrearages		2,525 52	Earnings apportioned	8,784 48
On shares	$987 00		Advance payments	18 00
On interest	1,421 00		Reserve and undivided profits	1,611 06
On fines, etc.	117 52			
Cash on hand and in bank		1,336 76		
Real estate owned		2,553 60		
Other assets		88 00		
Total assets		$38,395 54	Total liabilities	$38,395 54

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$7,701 09	Loans on mortgages and stock	$2,416 66
Installment stock—dues	5,136 00	Interest paid	3 60
Interest received	2,531 35	Dues repaid — installment stock	13,118 00
Premiums received	266 66	Profits repaid — installment stock	1,833 68
Fines received	56 90	Salaries	900 00
Fees received	70	Taxes	365 72
Loans repaid	4,740 00	Other expenses	55 78
All other receipts	80 00	All other disbursements	482 50
		Balance on hand and in bank	1,336 76
Total receipts	$20,512 70	Total disbursements	$20,512 70

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	320	181	$84 00	$111 18	$101 67
2	113	98	81 00	107 02	96 61
3	31	31	64 00	83 28	73 64
4	51	26	54 00	69 36	60 14
5	38	38	36 00	44 27	38 48
6	----------	7	12 00	12 52	12 05

No. 18—LOS ANGELES.

COLUMBIA LOAN AND BUILDING ASSOCIATION.

(Incorporated February 14, 1887.)

LEWIS THORNE, Secretary. A. M. EDELMAN, President.

Fiscal year ends January 31, 1899.

No. of series, 16. No. of shares, 1,379.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$104,800 00	Installment stock—dues	$64,218 00
Arrearages		1,110 27	Earnings apportioned	37,718 54
On shares	$291 00		Advance payments	1,429 84
On interest	344 50		Reserve and undivided profits	2 78
On premiums	16 00		Unearned premiums	4,170 00
On fines, etc.	458 77		Other liabilities	350 00
Cash on hand and in bank		528 89		
Real estate owned		1,000 00		
Other assets		450 00		
Total assets		$107,889 16	Total liabilities	$107,889 16

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$18,913 70	Overdrafts and bills payable	$940 46
Interest received	8,820 25	Loans on mortgages and stock	4,350 00
Premiums received	623 50	Dues repaid — installment stock	17,140 00
Fines received	101 56	Profits repaid — installment stock	4,555 19
Fees received	31 20	Salaries	600 00
Loans repaid	2,600 00	Taxes	2,485 92
		Other expenses	264 75
		All other disbursements	225 00
		Balance on hand and in bank	528 89
Total receipts	$31,090 21	Total disbursements	$31,090 21

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	136	97	$102 00	$202 88	$202 88
3	190	105	96 00	183 14	122 88
4	97	92	84 00	146 53	104 58
5	68	67	78 00	129 93	95 74
6	75	75	72 00	114 46	87 12
7	15	5	66 00	100 17	78 70
8	30	30	60 00	87 00	70 50
9	6	6	54 00	74 50	62 50
10	132	119	48 00	64 13	54 72
11	88	88	42 00	54 07	47 14
12	91	91	36 00	44 72	39 24
13	69	19	30 00	35 95	32 25
14	277	239	24 00	27 84	25 20
15	222	114	18 00	20 21	18 67
16	------------	167	12 00	13 03	12 30
17	------------	65	6 00	6 51	6 00

No. 19—LOS ANGELES.

BORROWERS MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated August 30, 1897.)

WM. MEAD, Secretary. R. M. BAKER, President.

Fiscal year ends September 30, 1898.

No. of series, none. No. of shares, 538.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$31,100 00	Installment stock—dues	$1,544 30
Cash on hand and in bank	31 55	Paid-up and prepaid stock	22,700 00
		Earnings apportioned	183 95
		Overdrafts and bills payable	6,000 00
		Reserve and undivided profits	653 30
		Other liabilities	50 00
Total assets	$31,131 55	Total liabilities	$31,131 55

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$1,544 30	Loans on mortgages and stock	$32,250 00
Paid-up and prepaid stock	23,700 00	Interest paid	367 50
Interest received	2,254 95	Paid-up and prepaid stock, and dividends	1,928 50
Loans repaid	1,200 00	Salaries	9 00
Overdrafts and bills payable	6,000 00	Other expenses	112 70
		Balance on hand and in bank	31 55
Total receipts	$34,699 25	Total disbursements	$34,699 25

STOCK IN FORCE.

Installment, shares	311
Paid-up, shares	227

No. 20—LOS ANGELES.

EQUITABLE BUILDING AND LOAN ASSOCIATION.

(Incorporated July 19, 1889.)

W. J. WASHBURN, Secretary. J. A. MUIR, President.

Fiscal year ends December 31, 1898.

No. of series, none. No. of shares, 2,942.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$132,494 86	Installment stock—dues	$30,635 79
Arrearages		302 40	Paid-up and prepaid stock	99,900 00
On interest	$302 40		Earnings apportioned	3,121 47
Cash on hand and in bank		4,141 81	Advance payments	211 50
			Reserve and undivided profits	3,070 31
Total assets		$136,939 07	Total liabilities	$136,939 07

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$9,745 31	Loans on mortgages and stock	$51,963 45
Installment stock—dues	46,340 85	Interest—paid-up stock	6,459 09
Paid-up and prepaid stock	31,000 00	Dues repaid — installment stock	34,008 03
Interest received	12,827 20	Profits repaid — installment stock	2,645 90
Loans repaid	28,228 60	Paid-up and prepaid stock	24,800 00
		Salaries	927 00
		Taxes	1,678 54
		Other expenses	1,518 14
		Balance on hand and in bank	4,141 81
Total receipts	$128,141 96	Total disbursements	$128,141 96

DIVIDENDS CREDITED TO STOCK PAYMENTS.

1894	8 per cent semi-annually.
1895	8¼ per cent semi-annually.
1896	8½ per cent semi-annually.
1897	8 per cent semi-annually.
1898	8 per cent semi-annually.

No. 21—LOS ANGELES.

FRATERNAL MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated April 17, 1895.)

HERBERT J. GOUDGE, Secretary. WILLIAM MEEK, President.

Fiscal year ends May 15, 1899.

No. of series, 13. No. of shares, 1,074.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$18,200 00	Installment stock—dues	$14,989 50
Arrearages		139 90	Earnings apportioned	2,539 16
On shares	$108 00		Advance payments	67 20
On interest	22 30		Reserve and undivided profits	52 01
On premiums	5 50		Other liabilities	1,199 70
On fines, etc.	4 10			
Cash on hand and in bank		369 17		
Other assets		138 50		
Total assets		$18,847 57	Total liabilities	$18,847 57

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$295 90	Overdrafts and bills payable	$1,850 00
Installment stock—dues	6,492 50	Loans on mortgages and stock	7,922 70
Interest received	1,488 15	Interest paid	34 39
Premiums received	474 50	Dues repaid — installment stock	3,269 00
Fines received	21 95	Profits repaid — installment stock	210 34
Fees received	32 20	Salaries	220 00
Loans repaid	3,552 80	Taxes	239 90
Overdrafts and bills payable	1,250 00	Other expenses	151 10
All other receipts	946 20	All other disbursements	287 60
		Balance on hand and in bank	369 17
Total receipts	$14,554 20	Total disbursements	$14,554 20

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	418	315	$24 00	$29 08	$27 39
2	77	49	22 50	26 99	25 49
3	95	85	19 50	22 93	21 79
4	26	23	18 00	20 95	19 97
5	39	39	15 00	17 09	16 04
6	92	48	13 50	15 20	14 35
7	26	26	12 00	13 36	12 68
8	10	10	9 00	9 77	9 38
9	250	201	7 50	8 04	7 77
10		71	6 00	6 36	6 18
11		105	4 50	4 70	4 60
12		69	3 00	3 09	3 04
13		35	1 50	1 53	1 51

No. 22—LOS ANGELES.

HOME INVESTMENT BUILDING AND LOAN ASSOCIATION.

(Incorporated August 19, 1889.)

W. A. Bonynge, Secretary. I. B. Newton, President.

Fiscal year ends September 30, 1898.

No. of series, 17. No. of shares, 1,745½.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$139,800 00	Installment stock—dues	$87,048 00
Arrearages		1,987 50	Earnings apportioned	51,410 80
On shares	$411 00		Advance payments	2,270 00
On interest	1,576 50		Overdrafts and bills payable	7,635 95
Cash on hand and in bank—sinking fund		757 30	Reserve and undivided profits	46 22
Real estate owned		7,121 30	Other liabilities	1,610 00
Other assets		354 87		
Total assets		$150,020 97	Total liabilities	$150,020 97

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$7,876 52	Overdrafts and bills payable	$15,349 77
Installment stock—dues	24,553 00	Loans on mortgages and stock	35,900 00
Interest received	14,375 02	Interest paid	723 99
Premiums received	4,345 00	Dues repaid — installment stock	36,642 00
Fines received	221 55	Profits repaid — installment stock	31,714 49
Fees received	123 25	Salaries	1,890 00
Loans repaid	68,085 00	Taxes	1,684 87
Overdrafts and bills payable	16,635 95	Other expenses	485 80
All other receipts	342 90	All other disbursements	11,409 97
		Balance on hand and in bank	757 30
Total receipts	$136,558 19	Total disbursements	$136,558 19

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	304	Matured.			
2	45	45	$102 00	$196 32	$191 61
3	106	99	96 00	177 38	173 32
4	178	174	90 00	164 17	160 47
5	108	108	84 00	143 71	140 73
6	87	72	78 00	130 22	119 78
7	54	54	72 00	115 35	106 69
8	36	36	66 00	104 71	91 81
9	111	106	60 00	93 54	82 36
10	85	85	54 00	78 26	66 13
11	134	130	48 00	65 84	56 92
12	55	55	42 00	56 62	47 48
13	249	191	36 00	48 74	40 78
14	148	83	30 00	35 97	31 49
15	138	121	24 00	27 44	24 86
16	149	144	18 00	18 86	18 10
17	----	87½	12 00	12 36	12 04
18	----	155	6 00	6 13	6 00

No. 23—LOS ANGELES.

LOS ANGELES BUILDING AND LOAN ASSOCIATION.

(Incorporated March 26, 1891.)

WM. MEAD, Secretary. ABBOT KINNEY, President.

Fiscal year ends March 31, 1899.

No. of series, 16. No. of shares, 894.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$58,613 30	Installment stock—dues	$42,030 00
Arrearages		3,045 90	Earnings apportioned	17,881 42
On shares	$1,046 00		Advance payments	608 70
On interest	1,179 50		Overdrafts and bills payable	6,600 00
On premiums	455 60		Reserve and undivided profits	04
On fines, etc.	364 80			
Cash on hand and in bank		667 26		
Real estate owned		4,613 70		
Other assets		180 00		
Total assets		$67,120 16	Total liabilities	$67,120 16

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$279 45	Overdrafts and bills payable	$8,400 00
Installment stock—dues	10,734 00	Loans on mortgages and stock	12,681 70
Interest received	4,623 35	Interest paid	1,045 66
Premiums received	1,674 65	Dues repaid — installment stock	5,912 00
Fines received	183 40	Profits repaid — installment stock	1,266 75
Loans repaid	11,478 00	Salaries	672 50
Overdrafts and bills payable	3,500 00	Taxes	791 38
All other receipts	105 00	Other expenses	184 95
		All other disbursements	955 65
		Balance on hand and in bank	667 26
Total receipts	$32,577 85	Total disbursements	$32,577 85

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	112	95	$96 00	$155 34	$149 41
2	88	83	90 00	142 16	131 73
3	41	32	84 00	129 43	115 80
4	20	20	78 00	117 17	101 50
5	30	30	72 00	105 38	89 28
6	15	15	66 00	94 05	80 53
7	11	11	60 00	83 18	72 00
8	29	29	54 00	72 78	63 72
9	91	81	48 00	62 84	55 68
10	123	88	42 00	53 36	47 14
11	79	58	36 00	44 34	39 78
12	18	18	30 00	35 79	32 25
13	137	96	24 00	27 71	25 44
14	108	83	18 00	20 09	18 81
15	----------	146	12 00	12 93	12 31
16	----------	9	6 00	6 23	6 00

No. 24—LOS ANGELES.

METROPOLITAN LOAN ASSOCIATION.

(Incorporated July 30, 1886.)

ISAAC NORTON, Secretary. CHAS. SEYLER, President.

Fiscal year ends June 30, 1898.

No. of series, 11. No. of shares, 3,730.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$221,050 00	Installment stock—dues	$164,102 00
Arrearages		582 50	Earnings apportioned	68,086 72
On shares	$254 00		Reserve and undivided profits	1,141 64
On interest	328 50		Other liabilities	2,560 00
Cash on hand and in bank		11,043 84		
Real estate owned		3,214 02		
Total assets		$235,890 36	Total liabilities	$235,890 36

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,140 35	Loans on mortgages and stock	$34,940 00
Installment stock—dues	47,968 00	Dues repaid — installment stock	39,643 00
Interest received	18,166 30	Profits repaid—installment stock	16,323 42
Premiums received	7,500 00	Salaries	2,250 00
Fines received	183 50	Taxes	2,680 45
Fees received	50 90	Other expenses	780 56
Loans repaid	32,700 00	All other disbursements	1,405 53
All other receipts	357 75	Balance on hand and in bank	11,043 84
Total receipts	$109,066 80	Total disbursements	$109,066 80

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
3	111	Matured.			
4	128	113	$106 00	$196 87	$160 00
5	79	79	102 00	190 01	154 00
6	126	121	96 00	167 92	146 34
7	268	175	84 00	138 39	122 07
8	228	167	72 00	111 10	97 49
9	460	400	60 00	83 06	73 84
10	602	510	48 00	62 33	55 16
11	1,180	934	36 00	43 41	38 96
12	843	758	24 00	27 08	24 61
13		432	12 00	12 74	12 07
14		41	6 00	6 19	6 00

No. 25—LOS ANGELES.

SAVINGS FUND AND BUILDING SOCIETY.

(Incorporated March 31, 1883.)

E. H. GRASETT, Secretary. WM. F. MARSHALL, Vice-President.

Fiscal year ends August 31, 1898.

No. of series, 9. No. of shares, 1,167.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$96,825 00	Installment stock—dues	$75,624 00
Arrearages		361 05	Earnings apportioned	30,114 96
On shares	$131 00		Reserve and undivided profits	437 44
On interest	157 33		Unearned premiums	6,125 22
On premiums	72 72			
Cash on hand and in bank		8,786 97		
Real estate owned		6,120 00		
Other assets		208 60		
Total assets		$112,301 62	Total liabilities	$112,301 62

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$5,519 92	Loans on mortgages and stock	$21,025 00
Installment stock—dues	14,713 00	Dues repaid — installment stock	15,757 00
Interest received	8,080 58	Profits repaid — installment stock	6,329 80
Premiums received	2,989 15	Salaries	934 00
Fines received	222 04	Taxes	1,244 85
Fees received	4 60	Other expenses	429 91
Loans repaid	25,525 00	All other disbursements	3,662 52
All other receipts	1,115 76	Balance on hand and in bank	8,786 97
Total receipts	$58,170 05	Total disbursements	$58,170 05

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
7	149	138	$108 00	$185 01	$178 31
8	152	102	96 00	149 65	141 60
9	226	213	84 00	120 09	112 87
10	143	100	72 00	95 01	89 26
11	204	171	60 00	73 54	69 48
12	177	168	48 00	55 16	52 66
13	111	111	36 00	39 24	39 24
14	184	129	24 00	25 10	25 20
15	-----------	35	12 00	12 21	12 24

No. 26—LOS ANGELES.

SOUTHERN CALIFORNIA LOAN ASSOCIATION.

(Incorporated March 11, 1887.)

JULIUS H. MARTIN, Secretary. C. E. DONNOTIN, President.

Fiscal year ends August 31, 1898.

No. of series, 15. No. of shares, 4,258.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$287,623 00	Installment stock—dues	$193,307 00
Arrearages	577 00	Paid-up and prepaid stock	30,300 00
On shares $577 00		Earnings apportioned	68,029 61
Cash on hand and in bank	6,564 67	Advance payments	440 00
Other assets	369 76	Reserve and undivided profits	1,333 11
		Other liabilities	1,724 71
Total assets	$295,134 43	Total liabilities	$295,134 43

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$570 74	Loans on mortgages and stock	$44,307 34
Installment stock—dues	52,222 00	Interest—paid-up stock	1,820 34
Interest received	24,826 96	Dues repaid — installment stock	30,567 00
Premiums received	4,645 00	Profits repaid — installment stock	13,141 90
Fines received	260 00	Paid-up and prepaid stock	200 00
Loans repaid	19,950 00	Salaries	1,738 00
All other receipts	546 97	Taxes	3,516 37
		Other expenses	431 89
		All other disbursements	734 16
		Balance on hand and in bank	6,564 67
Total receipts	$103,021 67	Total disbursements	$103,021 67

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	194	170	$103 00	$171 04	$171 04
5	501	459	91 00	140 03	127 77
6	288	273	79 00	113 32	104 74
7	65	65	63 00	101 56	90 13
8	238	220	67 00	90 47	81 08
9	114	104	60 00	78 26	70 95
10	437	404	54 00	68 54	61 27
11	204	190	48 00	59 25	53 62
12	385	317	42 00	50 45	42 23
13	361	306	36 00	42 06	39 03
14	418	373	30 00	34 11	32 05
15	348	268	24 00	26 64	25 32
16	468	413	18 00	19 44	18 72
17	----------	373	12 00	12 63	12 31
18	----------	323	6 00	6 17	6 08

No. 27—LOS ANGELES.

FIDELITY SAVINGS AND LOAN ASSOCIATION.

(Incorporated January 23, 1891.)

GEO. H. WADLEIGH, Secretary. C. C. BOYNTON, President.

Fiscal year ends December 31, 1898.

No. of series, none. No. of shares, 1,106.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$23,920 10	Installment stock—dues	$9,844 22
Arrearages		2,407 17	Paid-up and prepaid stock, and dividends	4,889 82
On shares	$1,723 00		Earnings apportioned	1,306 61
On interest	311 00		Overdrafts and bills payable	10,900 00
On premiums	373 17		Reserve and undivided profits	1,265 16
Cash on hand and in bank		1,170 51		
Other assets		708 03		
Total assets		$28,205 81	Total liabilities	$28,205 81

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$4,095 55	Overdrafts and bills payable	$11,602 35
Paid-up and prepaid stock	200 00	Loans on mortgages and stock	16,270 00
Interest received	865 40	Interest paid	523 50
Premiums received	1,013 23	Dues repaid — installment stock	4,620 63
Fees received	29 60	Profits repaid—installment stock	778 00
Loans repaid	9,574 90	Paid-up and prepaid stock, and dividends	1,844 26
Overdrafts and bills payable	20,050 00	Salaries	400 00
All other receipts	2,706 00	Taxes	225 58
		Other expenses	499 85
		All other disbursements	600 00
		Balance on hand and in bank	1,170 51
Total receipts	$38,534 68	Total disbursements	$38,534 68

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Class.	Shares Last Report.	Shares Now in Force.	Total Dues per Series.	Book Value per Series.
A	948	1,022	$9,844 22	$11,150 83
B	100	84	4,200 00	4,889 82

No. 28—LOS ANGELES.

STATE MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated June 20, 1889.)

C. J. WADE, Secretary. W. G. COCHRAN, President.

Fiscal year ends December 31, 1898.

No. of series, none. No. of shares, 24,085.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$594,403 25	Installment stock—dues	$295,502 60
Arrearages		3,943 55	Paid-up and prepaid stock	197,980 00
On interest	$2,294 65		Earnings apportioned	140,207 80
On premiums	1,263 65		Advance payments	155 60
On fines, etc.	385 25		Reserve and undivided profits	1,585 10
Cash on hand and in bank		11,121 10	Other liabilities	287 95
Real estate owned		21,821 79		
Other assets		4,429 36		
Total assets		$635,719 05	Total liabilities	$635,719 05

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,007 38	Loans on mortgages and stock	$183,186 31
Installment stock—dues	141,954 60	Interest paid	228 62
Paid-up and prepaid stock	475 00	Dues repaid — installment stock	130,071 80
Interest received	50,640 04	Profits repaid — installment stock	51,884 90
Premiums received	20,954 05	Paid-up and prepaid stock, and dividends	43,557 00
Fines received	1,465 48	Salaries	7,647 40
Loans repaid	220,694 56	Taxes	6,296 29
All other receipts	14,866 50	Other expenses	3,946 18
		All other disbursements	15,118 01
		Balance on hand and in bank	11,121 10
Total receipts	$453,057 61	Total disbursements	$453,057 61

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE AT AGES STATED.

Age.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
96 months—Loan Fund stock	$49 36	$80 87	$80 87
90 months—Loan Fund stock	46 36	73 21	73 21
84 months—Loan Fund stock	42 36	64 06	64 06
78 months—Loan Fund stock	39 30	57 30	56 60
72 months—Loan Fund stock	36 20	51 10	50 14
66 months—Loan Fund stock	33 10	45 23	44 66
60 months—Loan Fund stock	30 00	39 70	38 85
54 months—Loan Fund stock	26 90	34 46	34 42
48 months—Loan Fund stock	23 80	29 58	29 58
42 months—Net dividend plan	24 20	28 15	28 15
36 months—Net dividend plan	20 60	23 38	23 38
30 months—Net dividend plan	17 00	18 84	18 84
24 months—Net dividend plan	13 40	14 50	14 50
18 months—Net dividend plan	9 80	10 37	10 37
12 months—Net dividend plan	6 20	6 41	6 41
6 months—Net dividend plan	2 60	2 63	2 60

No. 29—LOS ANGELES.

UNION MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated October 8, 1891.)

HARVEY STURTEVANT, Secretary. E. P. JOHNSON, President.

Fiscal year ends October 31, 1898.

No. of series, 28. No. of shares, 7,830.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$197,256 81	Installment stock—dues	$129,559 50
Arrearages		9,633 33	Paid-up and prepaid stock	56,392 54
On shares	$5,095 90		Earnings apportioned	33,729 38
On interest	2,605 25		Overdrafts and bills payable	4,547 35
On premiums	1,581 68		Reserve and undivided profits	3,020 35
On fines, etc.	320 50		Unearned premiums	442 86
Cash on hand and in bank		5,212 47	Other liabilities	291 64
Real estate owned		3,785 85		
Other assets		12,095 16		
Total assets		$227,983 62	Total liabilities	$227,983 62

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$432 94	Overdrafts and bills payable	$12,816 16
Installment stock—dues	38,709 55	Loans on mortgages and stock	58,905 56
Paid-up and prepaid stock	25,050 00	Interest paid	886 71
Interest received	11,558 08	Dues repaid—installm't stock	47,134 86
Premiums received	10,314 58	Profits repaid—installm't st'k	12,704 35
Fines received	150 07	Paid-up and prepaid stock, and dividends	8,220 65
Fees received	166 67	Salaries	3,840 00
Loans repaid	61,265 50	Taxes	1,512 23
Overdrafts and bills payable	5,000 00	Other expenses	6,181 79
All other receipts	10,617 65	All other disbursements	5,850 26
		Balance on hand and in bank	5,212 47
Total receipts	$163,265 04	Total disbursements	$163,265 04

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	608	349	$42 00	$58 56	$56 20
2	189	155	40 50	55 27	53 87
3	162	107	39 00	53 58	51 40
4	230	158	37 50	51 24	48 93
5	232	149	36 00	48 71	46 45
6	221	126	34 50	45 52	44 00
7	61	46	33 00	43 84	41 55
8	174	149	31 50	41 21	39 10
9	304	250	30 00	38 44	36 95
10	401	303	28 50	36 39	34 20
11	204	164	27 00	34 55	31 75
12	323	205	25 50	32 33	29 30
13	365	307	24 00	29 61	26 85
14	244	189	22 50	27 61	24 40
15	482	336	21 00	25 70	22 00
16	346	256	19 50	23 69	19 90
17	434	334	18 00	21 35	18 80
18	366	243	16 50	19 25	17 10
19	267	277	15 00	17 45	15 60
20	191	99	13 50	15 55	14 00
21	487	290	12 00	13 22	12 20
22	605	282	10 50	11 57	10 50
23	451	331	9 00	9 87	9 00
24	569	227	7 50	8 23	7 50
25	----------	321	6 00	6 00	6 00
26	----------	382	4 50	4 50	4 50
27	----------	265	3 00	3 00	3 00
28	----------	319	1 50	1 50	1 50

No. 30—LOS ANGELES.

MECHANICS SAVINGS MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated July 20, 1895.)

A. M. BROWN, Secretary. W. F. BOSBYSHELL, President.

Fiscal year ends July 30, 1898.

No. of series, 12. No. of shares, 1,337.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$17,230 00	Installment stock—dues	$12,346 50
Arrearages	219 25	Paid-up and prepaid stock	4,570 00
On shares $219 25		Earnings apportioned	2,168 37
Cash on hand and in bank	1,039 25	Advance payments	202 50
Other assets	1,102 10	Reserve and undivided profits	283 27
		Other liabilities	19 96
Total assets	$19,590 60	Total liabilities	$19,590 60

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,498 34	Overdrafts and bills payable	$1,500 00
Installment stock—dues	6,765 00	Loans on mortgages and stock	14,385 90
Paid-up and prepaid stock	680 00	Interest paid	430 39
Interest received	2,201 65	Dues repaid — installment stock	3,135 00
Fines received	13 29	Profits repaid — installment stock	428 85
Fees received	65 70	Paid-up and prepaid stock	2,360 00
Loans repaid	10,372 00	Salaries	829 31
Overdrafts and bills payable	1,500 00	Taxes	262 35
All other receipts	1,683 61	Other expenses	1,128 79
		All other disbursements	279 75
		Balance on hand and in bank	1,039 25
Total receipts	$25,779 59	Total disbursements	$25,779 59

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	355	280	$18 00	$22 15	$22 15
2	161	91	16 50	20 02	20 02
3	132	95	15 00	18 00	18 00
4	57	48	13 50	15 80	15 80
5	20	20	12 00	13 60	13 60
6	93	70	10 50	11 70	11 70
7	103	78	9 00	9 87	9 87
8	95	85	7 50	8 11	8 11
9		22	6 00	6 37	6 37
10		49	4 50	4 73	4 73
11		211	3 00	3 10	3 10
12		288	1 50	1 55	1 50

No. 31—LOS ANGELES.

PROVIDENT MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated October 14, 1895.)

G. H. WADLEIGH, Secretary. L. W. BLINN, President.

Fiscal year ends October 31, 1898.

No. of series, 12. No. of shares, 14,447½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$146,499 00	Installment stock—dues	$58,519 08
Arrearages		2,581 10	Paid-up and prepaid stock	42,700 00
On shares	$2,302 45		Earnings apportioned	9,357 19
On interest	128 75		Advance payments	6,458 75
On premiums	149 90		Overdrafts and bills payable	17,781 75
Cash on hand and in bank		306 04	Reserve and undivided profits	5,025 49
Other assets		676 47	Other liabilities	10,220 35
Total assets		$150,062 61	Total liabilities	$150,062 61

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$379 49	Overdrafts and bills payable	$12,500 00
Installment stock—dues	43,898 29	Loans on mortgages and stock	110,472 57
Paid-up and prepaid stock	32,700 00	Interest paid	152 47
Interest received	4,850 53	Dues repaid — installment stock	3,674 13
Premiums received	5,413 45	Profits repaid — installment stock	190 23
Fines received	76 10	Paid-up and prepaid stock	3,650 00
Fees received	5 50	Salaries	1,800 00
Loans repaid	12,655 00	Taxes	275 46
Overdrafts and bills payable	30,281 25	Other expenses	15,650 99
All other receipts	22,231 25	All other disbursements	3,818 97
		Balance on hand and in bank	306 04
Total receipts	$152,490 86	Total disbursements	$152,490 86

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE AT AGES INDICATED.

Age, in Months.	Net Dues per Share.	Book Value per Share.	Withdrawal Value.
"A"—36 months—40 cts. per month	$12 75	$15 91	$13 38
30 months	10 70	12 93	11 15
24 months	8 60	10 05	8 89
18 months	4 66	5 09	5 09
12 months	2 52	2 72	2 72
6 months	36	38	38
"B"—30 months—70 cts. per month	20 57	25 27	21 51
24 months	15 12	17 63	15 62
18 months	9 54	10 55	10 55
12 months	5 76	6 22	6 22
6 months	1 98	2 06	2 06
"C"—30 months—$1 15 per month	30 81	37 24	32 18
24 months	24 84	28 97	25 68
18 months	16 82	18 73	18 73
12 months	10 62	11 47	11 47
6 months	4 41	4 59	4 59

No. 32—LOS ANGELES.

PROTECTIVE SAVINGS MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated January 2, 1896.)

WM. GEO. BLEWETT, Secretary. BYRON ERKENBRECKER, Vice-President.

Fiscal year ends February 28, 1899.

No. of series, none. No. of shares, 10,275 3/10.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$129,166 49	Installment stock—dues	$34,005 36
Arrearages		2,491 71	Paid-up and prepaid stock	92,356 31
On shares	$675 35		Advance payments	1,551 97
On interest	497 00		Reserve and undivided profits	5,869 04
On premiums	497 00		Other liabilities	15,101 99
On fines, etc.	822 36			
Cash on hand and in bank		2,392 78		
Other assets, including $10,313 01 contingent		14,833 69		
Total assets		$148,884 67	Total liabilities	$148,884 67

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$11,963 14	Overdrafts and bills payable	$2,500 00
Installment stock—dues	33,295 75	Loans on mortgages and stock	91,856 12
Paid-up and prepaid stock	57,052 06	Interest paid	57 19
Interest received	5,307 58	Dues repaid — installment stock	13,018 05
Premiums received	5,307 68	Profits repaid — installment stock	229 20
Fines received	901 86	Paid-up and prepaid stock	4,185 90
Fees received	460 85	Salaries	3,581 75
Loans repaid	18,204 41	Taxes	743 66
Overdrafts and bills payable	2,500 00	Other expenses	8,973 45
All other receipts	3,451 02	All other disbursements	10,906 25
		Balance on hand and in bank	2,392 78
Total receipts	$138,444 35	Total disbursements	$138,444 35

INSTALLMENT STOCK, WITH VALUE OF ONE SHARE AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.
"A"—36 months	$45 00	$34 50
11 months	13 75	9 50
"B"—34 months	34 00	26 00
30 months	30 00	22 80
12 months	12 00	8 40
"D"—35 months	21 00	16 08
30 months	18 00	13 68
23 months	13 80	10 32
18 months	10 80	7 92
12 months	7 20	5 04
6 months	3 60	2 16

No. 33—LOS ANGELES.

STATE OF CALIFORNIA MUTUAL BUILDING AND LOAN ASSOCIATION.

(Reincorporated April 7, 1898.)

W. L. VALENTINE, Secretary. GEO. EASTON, President.

Fiscal year ends February 28, 1899.

No. of series, none. No. of shares, 1,489½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$25,062 57	Installment stock—dues	$3,235 69
Arrearages		437 80	Paid-up and prepaid stock	17,811 50
On shares	$188 60		Earnings apportioned	1,450 93
On premiums	213 60		Advance payments	95 00
On fines, etc.	35 60		Overdrafts and bills payable	5,000 00
Cash on hand and in bank		2,718 29	Reserve and undivided profits	809 99
Other assets		184 45		
Total assets		$28,403 11	Total liabilities	$28,403 11

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$152 72	Overdrafts and bills payable	$75 00
Installment stock—dues	3,210 20	Loans on mortgages and stock	28,527 57
Paid-up and prepaid stock	18,670 50	Interest paid	213 48
Interest received	2,132 41	Dues repaid — installment stock	1,200 36
Premiums received	2,481 16	Paid-up and prepaid stock	1,300 00
Fines received	1 50	Salaries	1,670 27
Fees received	1,542 50	Taxes	5 30
Loans repaid	4,965 00	Other expenses	1,798 12
Overdrafts and bills payable	5,000 00	All other disbursements	647 60
		Balance on hand and in bank	2,718 29
Total receipts	$38,155 99	Total disbursements	$38,155 99

STOCK IN FORCE, WITH DUES PER SHARE.

Class.	Shares Now in Force.	Total Dues per Share.
A	819	60c per mo.
C	241	40c per mo.
D	66	$1 per mo.
Prepaid	363½	------------

No. 34—LOS GATOS.

LOS GATOS BUILDING AND LOAN ASSOCIATION.

(Incorporated April 27, 1889.)

A. Berryman, Secretary. P. Simon, President.

Fiscal year ends April 30, 1899.

No. of series, 5. No. of shares, 226½.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$28,400 00	Installment stock—dues	$19,908 00
Arrearages		26 80	Earnings apportioned	9,880 09
On shares	$10 00		Advance payments	20 00
On interest	11 80		Reserve and undivided profits	164 26
On premiums	5 00		Other liabilities	87 45
Cash on hand and in bank		1,633 (0		
Total assets		$30,059 80	Total liabilities	$30,059 80

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,485 28	Loans on mortgages and stock	$2,300 00
Installment stock—dues	2,984 00	Dues repaid — installment stock	2,733 00
Interest received	1,909 70	Profits repaid — installment stock	995 36
Premiums received	365 95	Salaries	300 00
Fines received	17 25	Taxes	313 87
Fees received	75	Other expenses	29 85
Loans repaid	1,650 00	All other disbursements	107 85
		Balance on hand and in bank	1,633 00
Total receipts	$8,412 93	Total disbursements	$8,412 93

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	145	123	$120 00	$192 06	Dues and one half of profits.
2	49	46	72 00	89 57	
3	8	8	60 00	71 63	
4	14½	14½	36 00	39 54	
5	28¾	34¾	24 00	25 72	

No. 35—MERCED.

MERCED MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated June 22, 1891.)

A. T. HASTINGS, Secretary. GEO. CONWAY, President.

Fiscal year ends June 30, 1898.

No. of series, 8. No. of shares, 538.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$40,455 00	Installment stock—dues	$32,232 00
Arrearages		750 55	Earnings apportioned	10,136 79
On shares	$326 00		Reserve and undivided profits	3 61
On interest	358 30		Unearned premiums	3,748 25
On fines	66 25		Other liabilities	820 00
Cash on hand and in bank		4,023 85		
Real estate owned		1,600 00		
Other assets		111 25		
Total assets		$46,940 65	Total liabilities	$46,940 65

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$0 34	Loans on mortgages and stock	$4,150 00
Installment stock—dues	6,738 00	Dues repaid — installment stock	5,946 00
Interest received	2,777 25	Profits repaid — installment stock	1,317 86
Premiums received	794 00	Salaries	240 00
Fines received	83 93	Taxes	448 52
Fees received	7 70	Other expenses	110 50
Loans repaid	8,600 00	All other disbursements	2,791 17
All other receipts	26 68	Balance on hand and in bank	4,023 85
Total receipts	$19,027 90	Total disbursements	$19,027 90

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	257	224	$84 00	$115 15	$112 00
2	60	30	78 00	104 32	94 57
3	61	56	72 00	93 94	87 12
4	44	32	66 00	84 04	78 80
6	33	23	48 00	56 87	55 52
7	50	50	36 00	40 70	38 02
8	46	46	24 00	25 94	24 84
9	----	77	12 00	12 46	12 00

No. 36—MODESTO.

MODESTO BUILDING AND LOAN ASSOCIATION.

(Incorporated October 10, 1889.)

G. P. SCHAFER, Secretary. A. HEWEL, President.

Fiscal year ends December 31, 1898.

No. of series, 6. No. of shares, 355.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$46,197 00	Installment stock—dues	$36,378 00
Arrearages		87 68	Earnings apportioned	20,014 25
On shares	$43 00		Reserve and undivided profits	29 76
On interest	36 58		Unearned premiums	38 66
On fines, etc.	8 10		Other liabilities	11 71
Cash on hand and in bank		1,272 70		
Real estate owned		8,900 00		
Other assets		15 00		
Total assets		$56,472 38	Total liabilities	$56,472 38

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$614 19	Dues repaid — installment stock	$28,731 00
Installment stock—dues	5,013 00	Profits repaid—installment stock	14,124 87
Interest received	3,332 48	Salaries	240 00
Fines received	36 20	Taxes	566 55
Fees received	1 50	Other expenses	183 70
Loans repaid	37,147 50	All other disbursements	1,625 05
All other receipts	599 00	Balance on hand and in bank	1,272 70
Total receipts	$46,743 87	Total disbursements	$46,743 87

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	383	219	$110 00	$179 34	$179 32
2	189	98	96 00	137 42	137 44
3	48	19	84 00	109 94	109 97
4	51	14	72 00	88 77	88 75
5	3	3	60 00	69 75	69 78
6	2	2	48 00	54 37	53 84

No. 37—NAPA.

NAPA BUILDING AND LOAN ASSOCIATION.

(Incorporated April 26, 1886.)

T. N. MOUNT, Secretary. E. D. BEARD, President.

Fiscal year ends May 8, 1899.

No. of series, 11. No. of shares, 969.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$126,960 00	Installment stock—dues	$88,977 00
Arrearages		250 55	Earnings apportioned	42,548 99
On shares	$46 00		Advance payments	110 00
On interest	54 35		Overdrafts and bills payable	153 18
On fines, etc.	150 20		Reserve and undivided profits	208 72
Real estate owned		4,521 34		
Other assets		266 00		
Total assets		$131,997 89	Total liabilities	$131,997 89

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$12,947 00	Overdrafts and bills payable	$1,834 83
Interest received	12,574 32	Loans on mortgages and stock	11,160 00
Premiums received	3 50	Interest paid	10 45
Fines received	2,744 72	Dues repaid — installment stock	37,044 00
Loans repaid	40,475 00	Profits repaid — installment stock	16,523 30
Overdrafts and bills payable	153 18	Salaries	720 00
All other receipts	2,594 00	Taxes	1,594 50
		Other expenses	197 34
		All other disbursements	2,407 30
Total receipts	$71,491 72	Total disbursements	$71,491 72

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	301	182	$125 00	$195 46	$157 81
5	345	342	113 00	170 58	139 83
6	143	129	101 00	147 00	122 46
7	53	40	89 00	124 72	105 68
8	89	45	77 00	103 74	89 51
9	39	39	65 00	84 05	73 93
10	13	10	53 00	65 67	58 96
11	24	24	41 00	48 58	44 58
12	101	101	29 00	32 79	30 18
13	18	22	17 00	18 30	17 63
14		35	5 00	5 11	5 06

No. 38—NEWCASTLE.

NEWCASTLE BUILDING AND LOAN ASSOCIATION.

(Incorporated May 22, 1889.)

ED. KATZENSTEIN, Secretary. C. H. KELLOGG, President.

Fiscal year ends May 26, 1899.

No. of series, 9. No. of shares, 195.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$13,700 00	Installment stock—dues	$10,008 00
Arrearages		329 16	Earnings apportioned	4,503 60
On shares	$59 00		Advance payments	6 00
On interest	80 80		Overdrafts and bills payable	2,250 00
On premiums	6 00		Reserve and undivided profits	110 39
On fines, etc.	183 36		Unearned premiums	288 40
Cash on hand and in bank		287 23		
Real estate owned		2,800 00		
Other assets		50 00		
Total assets		$17,166 39	Total liabilities	$17,166 39

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,502 76	Overdrafts and bills payable	$750 00
Installment stock—dues	3,134 00	Loans on mortgages and stock	1,750 00
Interest received	1,713 94	Dues repaid — installment stock	9,451 00
Premiums received	267 80	Profits repaid — installment stock	5,982 88
Fines received	192 41	Salaries	180 00
Fees received	3 70	Taxes	410 98
Loans repaid	11,740 67	Other expenses	63 00
Overdrafts and bills payable	3,000 00	All other disbursements	2,830 69
All other receipts	150 50	Balance on hand and in bank	287 23
Total receipts	$21,705 78	Total disbursements	$21,705 78

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	26	26	$108 00	$180 90	$173 61
3	11	6	96 00	153 60	147 84
4	17	12	84 00	128 10	119 28
5	19	13	72 00	104 40	94 68
6	40	27	60 00	82 50	71 25
7	35	35	48 00	62 40	53 76
8	25	15	36 00	41 10	38 43
9	9	9	24 00	27 60	24 72
10	------	52	12 00	12 90	12 04

No. 39—OAKLAND.

EQUITY BUILDING AND LOAN ASSOCIATION.

(Incorporated August 21, 1888.)

G. A. WILLARD, Secretary. J. B. McCHESNEY, President.

Fiscal year ends June 30, 1898.

No. of series, 19. No. of shares, 477⅞.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$55,232 60	Installment stock—dues	$14,222 10
Arrearages		832 35	Free stock, and earnings	51,449 55
On shares	$275 25		Earnings apportioned	5,211 43
On interest	336 85		Overdrafts and bills payable	16,900 00
On premiums	146 65		Reserve and undivided profits	11 79
On fines, etc.	73 60		Other liabilities	2 50
Cash on hand and in bank		3,992 51		
Real estate owned		27,145 21		
Other assets		594 70		
Total assets		$87,797 37	Total liabilities	$87,797 37

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$542 73	Overdrafts and bills payable	$12,613 33
Installment stock—dues	4,033 55	Loans on mortgages and stock	5,310 00
Free stock	3,408 25	Interest paid	939 70
Interest received	5,407 47	Dues repaid — installment stock	8,333 50
Premiums received	2,282 13	Profits repaid — installment stock	4,571 05
Fines received	226 27	Free stock	12,968 73
Fees received	2 90	Salaries	2,472 00
Loans repaid	27,216 37	Taxes	2,181 17
Overdrafts and bills payable	11,750 00	Other expenses	354 41
All other receipts	1,649 19	All other disbursements	2,782 46
		Balance on hand and in bank	3,992 51
Total receipts	$56,518 86	Total disbursements	$56,518 86

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share, Borrowing Stock.	Withdrawal Value.
2	55	39	$114 00	$192 74	$192 74
3	51	40½	108 00	179 36	179 36
4	7½	6½	102 00	----------	----------
5	3½	3½	96 00	----------	----------
6	32½	32½	90 00	142 27	142 27
7	17	16	84 00	129 86	129 86
8	83½	62½	78 00	116 57	116 57
9	38¾	16¾	72 00	103 60	103 60
10	42½	35½	66 00	90 98	90 98
11	14	7	60 00	78 69	78 69
12	26	17½	54 00	68 89	68 89
13	44½	2	48 00	----------	----------
14	60½	51½	42 00	47 82	47 82
15	23¾	23¾	36 00	38 23	38 23
16	7	7	30 00	31 08	31 08
17	57⅜	47⅜	24 00	24 12	24 12
18	37¾	37¾	18 00	18 03	18 03
19	----------	16¼	12 00	12 00	12 00
20	----------	15	6 00	6 00	6 00

No. 40—OAKLAND.

HOME SECURITY BUILDING AND LOAN ASSOCIATION.

(Incorporated July 20, 1875.)

C. K. CLARK, Secretary. C. E. PALMER, President.

Fiscal year ends June 30, 1898.

No. of series, 21. No. of shares, 3,397.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$301,436 05	Installment stock—dues	$214,968 00
Arrearages		14,722 55	Paid-up and prepaid stock	59,650 00
On shares	$4,995 00		Earnings apportioned	83,377 78
On interest	6,455 75		Advance payments	517 00
On premiums	2,814 05		Reserve and undivided profits	12,000 00
On fines, etc.	457 75		Other liabilities	6,600 54
Cash on hand and in bank		5,005 61		
Real estate owned		44,600 28		
Other assets		11,348 83		
Total assets		$377,113 32	Total liabilities	$377,113 32

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$6,483 61	Loans on mortgages and stock	$38,800 45
Installment stock—dues	41,971 00	Interest paid	436 30
Paid-up and prepaid stock	33,825 00	Dues repaid — installment stock	56,580 00
Interest received	22,508 10	Profits repaid — installment stock	25,995 95
Premiums received	7,906 50	Paid-up and prepaid stock	36,630 00
Fines received	495 65	Salaries	2,394 00
Fees received	60 20	Taxes	4,139 01
Loans repaid	70,322 85	Other expenses	941 48
All other receipts	14,339 72	All other disbursements	26,989 83
		Balance on hand and in bank	5,005 61
Total receipts	$197,912 63	Total disbursements	$197,912 63

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
23	44	44	$126 00	$197 55	$193 75
24	274	206	120 00	184 75	181 50
25	264	227	114 00	172 45	169 55
26	183	164	108 00	160 50	157 85
27	298	243	102 00	148 85	146 50
28	134	110	96 00	137 50	133 35
29	174	147	90 00	126 50	121 00
30	105	93	84 00	115 85	109 45
31	231	211	78 00	105 50	98 60
32	177	159	72 00	95 45	88 40
33	151	132	66 00	85 70	78 80
34	143	123	60 00	76 30	69 75
35	148	132	54 00	67 25	61 40
36	123	113	48 00	58 50	53 80
37	125	102	42 00	50 05	46 50
38	239	169	36 00	41 95	39 35
39	196	181	30 00	34 15	32 30
40	187	151	24 00	26 70	25 50
41	330	279	18 00	19 53	18 85
42	----------	211	12 00	12 70	12 40
43	----------	200	6 00	6 20	6 10

No. 41—OAKLAND.

PEOPLE'S BUILDING AND LOAN ASSOCIATION.

(Incorporated December, 1888.)

A. A. Deming, Secretary. J. W. Phillips, President.

Fiscal year ends December 31, 1898.

No. of series, 20. No. of shares, 612¼.

Financial Statement.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$43,570 25	Installment stock—dues	$37,672 50
Arrearages	10,503 68	Paid-up and prepaid stock	800 00
On shares $4,631 00		Earnings apportioned	14,678 86
On interest 3,561 93		Advance payments	55 00
On premiums 1,355 85		Overdrafts and bills payable	5,000 00
On fines, etc. 954 90		Reserve and undivided profits	11 73
Cash on hand and in bank	54 83	Other liabilities	160 25
Real estate owned	3,130 00		
Other assets	1,119 58		
Total assets	$58,378 34	Total liabilities	$58,378 34

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$7,385 75	Overdrafts and bills payable	$3,592 26
Paid-up and prepaid stock	400 00	Loans on mortgages and stock	12,550 00
Interest received	2,696 01	Interest paid	466 80
Premiums received	1,009 37	Dues repaid — installment stock	10,643 00
Fines received	76 31	Profits repaid — installment stock	2,742 35
Loans repaid	16,216 97	Paid-up and prepaid stock	1,300 00
Overdrafts and bills payable	7,500 00	Salaries	960 00
All other receipts	137 70	Taxes	621 99
		Other expenses	235 63
		All other disbursements	2,255 25
		Balance on hand and in bank	54 83
Total receipts	$35,422 11	Total disbursements	$35,422 11

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	166	124	$120 00	$186 24	$163 70
2	9	4	114 00	171 85	153 00
3	29	29	108 00	158 45	142 60
4	11	6	102 00	145 69	132 50
5	48¼	38¼	96 00	133 62	122 70
6	12	1	90 00	122 17	113 20
7	36	36	84 00	110 22	104 00
8	24	14	78 00	101 04	95 05
9	30	25	72 00	91 12	86 35
10	3	3	66 00	81 74	77 95
11	34½	27	60 00	72 70	69 75
12	11	11	54 00	64 15	61 80
13	25	20	48 00	55 86	54 10
14	12	11	42 00	47 95	46 60
15	30	27	36 00	40 38	39 40
16	45½	42½	30 00	33 02	32 35
17	90	55	24 00	25 93	25 50
18	73	36	18 00	19 09	18 85
19	----------	58¾	12 00	12 49	12 40
20	----------	43¾	6 00	6 13	6 10

No. 42—OAKLAND.

STANDARD BUILDING AND LOAN ASSOCIATION.

(Incorporated October 1, 1890.)

HERBERT F. KELLOGG, Secretary. CHAS. W. KELLOGG, President.

Fiscal year ends October 28, 1898.

No. of series, 16. No. of shares, 558½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$36,625 00	Installment stock—dues	$33,903 00
Arrearages		2,258 42	Paid-up and prepaid stock	2,400 00
On shares	$790 00		Earnings apportioned	12,498 08
On interest	951 20		Advance payments	54 00
On premiums	417 82		Overdrafts and bills payable	500 00
On fines, etc.	99 40		Reserve and undivided profits	302 57
Cash on hand and in bank		4,463 21	Other liabilities	691 31
Real estate owned		5,427 33		
Other assets		1,575 00		
Total assets		$50,348 96	Total liabilities	$50,348 96

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$410 91	Loans on mortgages and stock	$5,175 00
Installment stock—dues	6,459 00	Dues repaid — installment stock	5,310 00
Interest received	2,479 78	Profits repaid—installment stock	818 52
Premiums received	939 56	Paid-up and prepaid stock	1,050 00
Fines received	58 48	Salaries	600 00
Fees received	7 30	Taxes	569 14
Loans repaid	6,240 00	Other expenses	203 50
All other receipts	5,411 19	All other disbursements	3,816 85
		Balance on hand and in bank	4,463 21
Total receipts	$22,006 22	Total disbursements	$22,006 22

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	188	167	$96 00	$141 82	$120 44
2	42½	31½	90 00	128 58	107 64
3	22	17	84 00	116 52	101 64
4	37	27	78 00	105 53	90 64
5	17	17	72 00	94 44	84 64
6	41	41	66 00	84 46	75 00
7	28	21	60 00	74 46	69 00
8	12	7	54 00	65 52	59 76
9	60	60	48 00	56 59	53 76
10	11	11	42 00	48 48	45 24
11	10	10	36 00	40 43	39 24
12	48	38	30 00	33 14	31 44
13	41	10	24 00	25 87	25 44
14	27	12	18 00	19 18	18 36
15		48	12 00	12 49	12 36
16		10	6 00	6 24	6 00

No. 43—EAST OAKLAND.

BROOKLYN INVESTMENT AND LOAN ASSOCIATION.

(Incorporated October 14, 1889.)

I. I. BOOK, Secretary. C. H. DALY, President.

Fiscal year ends October 31, 1898.

No. of series, 32. No. of shares, 2,694½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$42,250 15	Installment stock—dues	$55,487 62
Arrearages		1,711 60	Earnings apportioned	9,644 94
On shares	$663 45		Advance payments	286 35
On interest	697 35		Reserve and undivided profits	826 84
On premiums	305 25		Other liabilities	1,101 38
On fines, etc.	45 55			
Cash on hand and in bank		2,729 03		
Real estate owned		20,078 25		
Other assets		578 10		
Total assets		$67,347 13	Total liabilities	$67,347 13

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,145 88	Overdrafts and bills payable	$7,400 00
Installment stock—dues	17,301 35	Loans on mortgages and stock	8,900 00
Interest received	3,609 30	Interest paid	430 72
Premiums received	1,366 25	Dues repaid—installm't stock	15,200 60
Fines received	173 80	Profits repaid—installm't st'k	1,317 75
Loans repaid	16,074 85	Salaries	600 00
All other receipts	5,050 72	Taxes	1,151 37
		Other expenses	382 25
		All other disbursements	7,610 43
		Balance on hand and in bank	2,729 03
Total receipts	$45,722 15	Total disbursements	$45,722 15

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
3	117½	97½	$48 00	$65 40	$57 60
4	20	20	46 50	62 22	54 92
5	67½	30	45 00	59 16	53 43
6	30	30	43 50	56 35	51 38
7	25	25	42 00	53 56	49 35
8	162	122	40 50	50 86	46 82
9	72	72	39 00	48 25	45 19
10	161	161	37 50	45 77	43 35
11	15½	15½	36 00	43 39	41 40
12	77	77	34 50	41 06	39 04
13	20½	20½	33 00	38 84	37 53
14	39	26½	31 50	36 68	35 61
15	88¼	66¼	30 00	34 58	33 75
16	84	79	28 50	32 51	31 89
17	77	42	27 00	30 53	30 00
18	41	16	25 50	28 59	28 20
19	61	36½	24 00	26 68	26 40
20	217	182	22 50	24 85	24 60
21	108½	80	21 00	23 02	22 83
22	20½	12½	19 50	21 23	21 08
23	346½	275	18 00	19 45	19 35
24	65	40	16 50	17 72	17 62
25	190	102	15 00	15 99	15 94
26	144	184	13 50	14 29	14 25
27	164	74	12 00	12 62	12 60
28	320½	265½	10 50	10 98	10 97
29	168	58	9 00	9 35	9 34
30	135¼	87¼	7 50	7 75	7 72
31		190½	6 00	6 15	6 15
32		50	4 50	4 59	4 59
33		70	3 00	3 04	3 03
34		187	1 50	1 52	1 51

No. 44—EAST OAKLAND.

COSMOPOLITAN MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated August 4, 1879.)

WILSON S. GOULD, Secretary. DAVID SYMMES, President.

Fiscal year ends July 31, 1898.

No. of series, 20. No. of shares, 1,935¼.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$117,180 85	Installment stock—dues	$101,496 00
Arrearages		4,979 65	Earnings apportioned	32,959 64
On shares	$1,895 65		Advance payments	4,696 99
On interest	2,189 45		Overdrafts and bills payable	12,050 00
On premiums	652 85		Reserve and undivided profits	639 28
On fines, etc.	241 70		Unearned premiums	134 97
Cash on hand and in bank		6,741 25	Other liabilities	1,070 00
Real estate owned		23,285 00		
Other assets		860 13		
Total assets		$153,046 88	Total liabilities	$153,046 88

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$360 54	Overdrafts and bills payable	$15,700 00
Installment stock—dues	27,371 64	Loans on mortgages and stock	20,645 00
Interest received	8,905 17	Interest paid	1,148 50
Premiums received	2,026 55	Dues repaid — installment stock	28,874 80
Fines received	305 89	Profits repaid — installment stock	11,535 62
Loans repaid	47,445 00	Salaries	1,717 50
All other receipts	11,509 87	Taxes	2,458 47
		Other expenses	342 20
		All other disbursements	8,761 32
		Balance on hand and in bank	6,741 25
Total receipts	$97,924 66	Total disbursements	$97,924 66

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
20	88	73	$120 00	$189 42	$189 42
21	68	61	114 00	174 98	171 93
22	152	145	108 00	161 08	155 77
23	103	98	102 00	147 87	140 98
24	62	43	96 00	135 28	127 42
25	35	22	90 00	123 02	114 76
26	104½	95½	84 00	111 51	103 25
27	46½	46½	78 00	100 62	92 70
28	49	49	72 00	90 43	83 05
29	92	84	66 00	80 89	74 18
30	47	47	60 00	71 82	65 91
31	174	115½	54 00	63 19	58 59
32	72½	72½	48 00	54 97	51 48
33	112½	90	42 00	47 10	44 55
34	171½	117¼	36 00	39 66	37 83
35	189¼	145¾	30 00	32 48	31 24
36	142	97¼	24 00	25 55	24 77
37	172½	127	18 00	18 84	18 42
38	----------	221¾	12 00	12 38	12 19
39	----------	184¼	6 00	6 10	6 05

No. 45—EAST OAKLAND.

OAKLAND BUILDING AND LOAN ASSOCIATION.

(Incorporated April 24, 1890.)

GEORGE BURBECK, Secretary. AUSTIN J. ROBERTS, President.

Fiscal year ends December 31, 1898.

No. of series, 80. No. of shares, 1,855.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$124,522 00	Installment stock—dues	$76,036 50
Arrearages		8,441 05	Paid-up and prepaid stock	250 00
On shares	$3,539 75		Earnings apportioned	25,589 65
On interest	4,175 81		Advance payments	440 45
On premiums	358 48		Overdrafts and bills payable	30,000 00
On fines, etc.	367 01		Reserve and undivided profits	6,713 36
Cash on hand and in bank		487 55	Other liabilities	44,334 41
Real estate owned		45,525 28		
Other assets		4,388 49		
Total assets		$183,364 37	Total liabilities	$183,364 37

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$710 42	Overdrafts and bills payable	$40,000 00
Installment stock—dues	18,501 95	Loans on mortgages and stock	1,600 00
Paid-up and prepaid stock	700 00	Interest paid	5,617 90
Interest received	12,061 02	Dues repaid — installment stock	41,416 95
Premiums received	1,420 91	Profits repaid — installment stock	11,555 59
Fines received	975 49	Paid-up and prepaid stock	450 00
Fees received	6 45	Salaries	1,620 00
Loans repaid	42,855 00	Taxes	2,164 38
Overdrafts and bills payable	45,000 00	Other expenses	562 60
All other receipts	39,718 01	All other disbursements	56,474 28
		Balance on hand and in bank	487 55
Total receipts	$161,949 25	Total disbursements	$161,949 25

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE AT AGES INDICATED.

Age.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
74 months	$74 00	$99 61	$86 80
72 months	72 00	94 57	83 07
66 months	66 00	83 48	74 74
61 months	61 00	75 11	68 05
55 months	55 00	65 80	60 40
48 months	48 00	55 43	51 71
42 months	42 00	47 27	44 60
36 months	36 00	39 64	37 82
29 months	29 00	31 26	30 13
25 months	25 00	26 66	25 83
17 months	17 00	17 77	17 35
12 months	12 00	12 39	12 20
8 months	8 00	8 18	8 09
3 months	3 00	3 03	3 01

No. 46—WEST OAKLAND.

WEST OAKLAND MUTUAL LOAN ASSOCIATION.

(Incorporated July 21, 1875.)

A. SBARBORO, Secretary. C. A. MALM, President.

Fiscal year ends August 31, 1898.

No. of series, 13. No. of shares, 1,161½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$95,200 00	Installment stock—dues	$88,484 00
Arrearages		1,584 50	Earnings apportioned	20,505 54
On shares	$536 50		Advance payments	125 00
On interest	541 50		Reserve and undivided profits	730 56
On fines, etc.	506 50		Other liabilities	586 65
Cash on hand and in bank		6,557 30		
Real estate owned		6,322 20		
Other assets		767 75		
Total assets		$110,431 75	Total liabilities	$110,431 75

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$13,438 09	Loans on mortgages and stock	$800 00
Installment stock—dues	15,163 50	Interest paid	169 96
Interest received	6,374 85	Dues repaid — installment stock	37,884 50
Premiums received	383 25	Profits repaid — installment stock	11,545 29
Fines received	321 95	Salaries	1,800 00
Fees received	11 20	Taxes	1,287 42
Loans repaid	28,720 00	Other expenses	496 62
All other receipts	2,756 19	All other disbursements	6,627 94
		Balance on hand and in bank	6,557 30
Total receipts	$67,169 03	Total disbursements	$67,169 03

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
9	178	10	$143 00	$200 00	$200 00
10	63	58	144 00	196 01	183 00
11	72	70	132 00	176 38	165 28
12	107½	85	120 00	156 71	147 53
13	115	96	108 00	135 99	128 99
14	178	168	96 00	118 46	112 84
15	102	82	84 00	99 90	95 92
16	143½	118½	72 00	83 46	80 59
17	121	116	60 00	67 33	64 39
18	110	75	48 00	52 41	50 20
19	121½	106½	36 00	38 42	37 21
20	179½	69½	24 00	25 24	24 62
12	----------	107	12 00	12 42	12 21

No. 47—ONTARIO.

PEOPLE'S MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated June 24, 1891.)

I. S. MILLER, Secretary. A. P. HARWOOD, President.

Fiscal year ends June 1, 1898.

No. of series, 27. No. of shares, 1,486.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$75,300 00	Installment stock—dues	$45,039 60
Arrearages		2,965 95	Earnings apportioned	21,915 97
On shares	$1,231 69		Advance payments	513 91
On interest	1,526 96		Overdrafts and bills payable	5,402 41
On fines, etc.	207 30		Reserve and undivided profits	51
Cash on hand and in bank		2,034 01	Unearned premiums	7,287 20
Real estate owned		700 00	Other liabilities	971 80
Other assets		131 44		
Total assets		$81,131 40	Total liabilities	$81,131 40

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,086 24	Overdrafts and bills payable	$5,267 42
Installment stock—dues	9,646 70	Loans on mortgages and stock	13,634 68
Interest received	5,666 84	Interest paid	968 47
Premiums received	2,880 00	Dues repaid — installment stock	982 80
Fines received	199 46	Profits repaid — installment stock	96 00
Fees received	36 50	Salaries	500 00
Loans repaid	3,400 00	Taxes	1,004 87
Overdrafts and bills payable	402 41	Other expenses	248 49
All other receipts	972 56	All other disbursements	553 97
		Balance on hand and in bank	2,034 01
Total receipts	$25,290 71	Total disbursements	$25,290 71

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	282	282	$50 40	$81 68	$51 90
2	101	101	48 60	77 69	50 05
3	10	10	46 80	73 78	48 20
4	39	39	45 00	69 94	46 35
5	40	40	43 20	66 18	44 50
6	50	50	41 40	62 50	42 65
7	40	40	39 60	58 91	40 80
8	38	38	37 80	55 40	38 95
9	142	122	36 00	51 96	37 10
10	20	20	34 20	48 60	35 25
11	51	51	32 40	45 33	33 40
12	34	34	30 60	42 13	31 55
13	30	30	28 80	39 01	29 70
14	16	16	27 00	35 98	27 85
15	68	61	25 20	33 02	26 00
16	53	53	23 40	30 14	24 15
17	48	48	21 60	27 34	22 30
18	40	40	19 80	24 63	20 45
19	50	50	18 00	21 99	18 60
20	25	25	16 20	19 43	16 75
21	38	25	14 40	16 95	14 90
23	25	19	10 80	12 23	11 15
24	5	5	9 00	10 00	9 30
25		30	7 20	7 83	7 45
26		120	5 40	5 75	5 60
27		100	3 60	3 76	3 75
28		37	1 80	1 84	1 90

No. 48—ORANGE.

ORANGE BUILDING AND LOAN ASSOCIATION.

(Incorporated September 26, 1887.)

W. H. H. CLAYTON, Secretary. D. C. PIXLEY, President

Fiscal year ends October 31, 1898.

No. of series, 4. No. of shares, 765⅛.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$32,440 00	Installment stock—dues	$20,609 25
Arrearages		53 99	Earnings apportioned	2,409 34
On shares	$28 00		Advance payments	1,083 95
On interest	18 00		Overdrafts and bills payable	8,675 80
On premiums	4 73		Reserve and undivided profits	1 12
On fines, etc.	3 26		Other liabilities	775 22
Cash on hand and in bank		1,012 81		
Other assets		47 88		
Total assets		$33,554 68	Total liabilities	$33,554 68

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,323 47	Overdrafts and bills payable	$4,500 00
Installment stock—dues	9,972 50	Loans on mortgages and stock	11,960 28
Interest received	1,397 10	Interest paid	596 75
Premiums received	678 40	Dues repaid — installment stock	1,279 50
Fines received	15 39	Profits repaid — installment stock	111 48
Loans repaid	2,700 00	Salaries	150 00
Overdrafts and bills payable	3,575 80	Taxes	50 51
All other receipts	99 48	Other expenses	44 00
		All other disbursements	56 81
		Balance on hand and in bank	1,012 81
Total receipts	$19,762 14	Total disbursements	$19,762 14

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	249½	224½	$42 00	$48 62	$44 64
3	208½	206½	30 00	32 98	30 59
4	209	248⅜	18 00	19 17	18 11
5	------------	85¾	6 00	6 20	6 00

No. 49—PALO ALTO.

PALO ALTO MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated November 14, 1892.)

MARSHALL BLACK, Secretary. J. S. BUTLER, President.

Fiscal year ends November 30, 1898.

No. of series, 13. No. of shares, 546.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$33,200 00	Installment stock—dues	$17,908 00
Arrearages		460 80	Earnings apportioned	4,980 23
On shares	$128 00		Advance payments	702 40
On interest	228 65		Overdrafts and bills payable	9,425 00
On premiums	62 75		Reserve and undivided profits	210 77
On fines, etc.	41 40		Other liabilities	747 50
Cash on hand and in bank		235 38		
Other assets		77 72		
Total assets		$33,973 90	Total liabilities	$33,973 90

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$249 30	Overdrafts and bills payable	$12,250 00
Installment stock—dues	6,417 00	Loans on mortgages and stock	14,558 00
Interest received	2,322 35	Interest paid	678 79
Premiums received	883 95	Dues repaid — installment stock	3,101 00
Fines received	2 55	Profits repaid — installment stock	471 40
Fees received	26 00	Salaries	150 00
Loans repaid	8,300 00	Taxes	528 53
Overdrafts and bills payable	13,875 00	Other expenses	43 35
		All other disbursements	59 70
		Balance on hand and in bank	235 38
Total receipts	$32,076 15	Total disbursements	$32,076 15

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	189	156	$72 00	$97 55	$85 00
2	16	6	69 00	91 98	79 35
3	23	23	59 00	75 20	67 60
4	1	1	48 00	58 66	53 80
5	12	6	42 00	50 24	46 65
6	24	24	33 00	38 32	35 85
7	56	52	24 00	26 86	25 45
8	29	26	18 00	19 64	18 70
9	23	23	15 00	16 06	15 60
10		64	12 00	12 77	12 38
11		66	9 00	9 35	9 00
12		31	6 00	6 15	6 00
13		68	3 00	3 05	3 00

No. 50—PASADENA.

MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated July 20, 1892.)

R. H. Pinney, Secretary. T. P. Lukens, President.

Fiscal year ends June 30, 1898.

No. of series, 12. No. of shares, 1,441.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$44,110 00	Installment stock—dues	$26,316 00
Arrearages		381 85	Paid-up and prepaid stock	12,305 87
On shares	$190 00		Earnings apportioned	7,895 99
On interest	85 25		Advance payments	491 00
On premiums	85 00		Reserve and undivided profits	157 19
On fines, etc.	21 60		Other liabilities	24 20
Cash on hand and in bank		2,558 40		
Other assets		140 00		
Total assets		$47,190 25	Total liabilities	$47,190 25

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$596 70	Overdrafts and bills payable	$1,500 00
Installment stock—dues	8,219 00	Loans on mortgages and stock	19,209 80
Paid-up and prepaid stock	7,300 00	Interest paid	63 62
Interest received	2,260 55	Dues repaid — installment stock	3,168 50
Premiums received	2,251 40	Profits repaid — installment stock	524 10
Fines received	43 80	Salaries	240 00
Fees received	50 35	Taxes	3 22
Loans repaid	7,145 00	Other expenses	522 71
All other receipts	35 05	All other disbursements	111 50
		Balance on hand and in bank	2,558 40
Total receipts	$27,901 85	Total disbursements	$27,901 85

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	345	305	$36 00	$50 86	$47 13
2	69	69	33 00	45 30	40 38
3	95	83	30 00	40 01	36 00
4	72	62	27 00	34 91	30 95
5	25	30	24 00	30 15	27 07
6	86	66	21 00	25 58	23 26
7	34	24	18 00	21 28	19 64
8	101	101	15 00	17 22	16 11
9	198	148	12 00	13 42	12 71
10	247	174	9 00	9 75	9 00
11	----	121	6 00	6 34	6 00
12	----	258	3 00	3 09	3 00

No. 51—PETALUMA.

PETALUMA MUTUAL LOAN ASSOCIATION.

(Incorporated September, 1889.)

LYMAN GREEN, Secretary. F. A. MEYER, President.

Fiscal year ends September 30, 1898.

No. of series, 10. No. of shares, 747.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$62,673 80	Installment stock—dues	$57,222 00
Arrearages		2,783 05	Earnings apportioned	16,797 49
On shares	$1,366 30		Reserve and undivided profits	252 11
On interest	999 05			
On premiums	184 45			
On fines, etc.	233 25			
Cash on hand and in bank		6,288 75		
Real estate owned		2,386 00		
Other assets		140 00		
Total assets		$74,271 60	Total liabilities	$74,271 60

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,397 28	Overdrafts and bills payable	$1,200 00
Installment stock—dues	9,160 70	Loans on mortgages and stock	2,100 00
Interest received	4,037 25	Interest paid	12 00
Premiums received	482 75	Dues repaid — installment stock	8,620 00
Fines received	147 90	Profits repaid — installment stock	2,521 70
Loans repaid	4,651 20	Salaries	420 00
Overdrafts and bills payable	1,200 00	Taxes	816 75
All other receipts	55 25	Other expenses	153 13
		Balance on hand and in bank	6,288 75
Total receipts	$22,132 33	Total disbursements	$22,132 33

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	174	129	$108 00	$154 95	Varies as to age.
2	40	35	102 00	140 97	
3	188	158	96 00	126 50	
4	127	122	84 00	104 27	
5	94	94	72 00	85 64	
6	54½	49½	60 00	69 14	
7	35	25	48 00	53 68	
8	34	29	36 00	39 02	
9	88	88	24 00	25 31	
10		17½	12 00	12 32	

No. 52—PLEASANTON.

PLEASANTON MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated March 1, 1895.)

T. H. SILVER, Secretary. W. H. COPE, President.

Fiscal year ends March 22, 1899.

No. of series, 6. No. of shares, 217.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$11,550 00	Installment stock—dues	$7,584 00
Cash on hand and in bank	182 57	Paid-up and prepaid stock	1,148 57
		Overdrafts and bills payable	3,000 00
Total assets	$11,732 57	Total liabilities	$11,732 57

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$322 87	Overdrafts and bills payable	$600 00
Installment stock—dues	2,651 00	Loans on mortgages and stock	5,300 00
Interest received	599 50	Interest paid	168 80
Premiums received	305 50	Dues repaid — installment stock	1,030 00
Fees received	2 00	Profits repaid — installment stock	103 75
Overdrafts and bills payable	3,600 00	Salaries	24 00
All other receipts	50 00	Taxes	91 42
		Other expenses	28 33
		All other disbursements	2 00
		Balance on hand and in bank	182 57
Total receipts	$7,530 87	Total disbursements	$7,530 87

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	140	115	$48 00	$56 25	Dues and 83% of profits.
2	11	11	36 00	41 07	
3	23	23	30 00	33 35	
4	21	21	24 00	26 15	
6		32	12 00	12 60	
7		15	6 00	6 11	

No. 53—POMONA.

MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated December 24, 1892.)

C. I. LORBEER, Secretary. J. T. BRADY, President.

Fiscal year ends December 31, 1898.

No. of series, 12. No. of shares, 1,320.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$30,625 00	Installment stock—dues	$26,418 00
Arrearages		160 45	Earnings apportioned	6,354 14
On shares	$57 50		Advance payments	133 50
On interest	71 90		Reserve and undivided profits	48
On premiums	16 65		Other liabilities	1,820 00
On fines, etc.	14 40			
Cash on hand and in bank		3,804 72		
Other assets		135 95		
Total assets		$34,726 12	Total liabilities	$34,726 12

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,155 31	Loans on mortgages and stock	$15,570 00
Installment stock—dues	8,488 00	Interest paid	16 40
Interest received	2,558 45	Dues repaid — installment stock	3,780 00
Premiums received	829 30	Profits repaid — installment stock	428 71
Fines received	70 40	Salaries	571 00
Fees received	31 20	Taxes	383 28
Loans repaid	11,600 00	Other expenses	93 30
All other receipts	4 00	All other disbursements	89 25
		Balance on hand and in bank	3,804 72
Total receipts	$24,736 66	Total disbursements	$24,736 66

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	187	177	$36 00	$48 66	$45 49
2	116	104	33 00	43 36	38 93
3	152	135	30 00	38 35	34 84
4	46	28	27 00	33 61	30 89
5	160	128	24 00	29 11	27 04
6	130	107	21 00	24 87	23 31
7	113	80	18 00	20 77	19 67
8	95	85	15 00	16 87	16 15
9	169	139	12 00	13 16	12 73
10	129	89	9 00	9 64	9 41
11		187	6 00	6 28	6 18
12		61	3 00	3 07	3 05

No. 54—REDWOOD CITY.

SAN MATEO COUNTY BUILDING AND LOAN ASSOCIATION.

(Incorporated May 8, 1890.)

GEO. W. LOVIE, Secretary. P. P. CHAMBERLAIN, President.

Fiscal year ends May 31, 1899.

No. of series, 26. No. of shares, 2,528.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$153,288 50	Installment stock—dues	$129,300 00
Arrearages		3,791 65	Earnings apportioned	46,773 47
On shares	$2,135 00		Advance payments	376 40
On interest	1,306 75		Reserve and undivided profits	1,653 32
On premiums	349 90		Other liabilities	2,329 57
Cash on hand and in bank		12,046 09		
Real estate owned		10,720 92		
Other assets		585 60		
Total assets		$180,432 76	Total liabilities	$180,432 76

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$8,235 51	Loans on mortgages and stock	$37,272 28
Installment stock—dues	29,767 00	Interest paid	166 62
Interest received	12,299 47	Dues repaid — installment stock	22,815 00
Premiums received	4,771 85	Profits repaid—installment stock	10,106 89
Fines received	64 95	Salaries	1,089 50
Fees received	106 45	Taxes	2,306 88
Loans repaid	30,259 96	Other expenses	338 92
All other receipts	5,944 24	All other disbursements	5,307 25
		Balance on hand and in bank	12,046 09
Total receipts	$91,449 43	Total disbursements	$91,449 43

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	215	78	$108 00	$171 00	$171 00
2	116	100	102 00	157 55	145 00
3	259	239	96 00	144 00	136 80
4	161	146	90 00	132 00	123 60
5	87	87	84 00	120 01	112 81
6	96	96	78 00	108 50	100 88
7	71	71	72 00	97 60	91 20
8	78	78	66 00	87 15	80 81
9	139	131	60 00	78 23	72 07
10	158	146	54 00	67 72	62 92
11	90	72	48 00	58 71	54 97
12	60	57	45 00	54 30	50 28
13	148	148	42 00	50 07	46 50
14	80	52	39 00	45 92	42 90
15	117	111	36 00	41 87	39 33
16	83	68	33 00	37 87	34 87
17	83	78	30 00	34 02	31 55
18	51	30	27 00	30 25	28 26
19	135	100	24 00	26 57	25 00
20	88	77	21 00	22 93	21 77
21	103	100	18 00	19 43	18 57
22	93	88	15 00	16 00	15 40
23	----	93	12 00	12 65	12 26
24	----	136	9 00	9 35	9 00
25	----	74	6 00	6 17	6 00
26	----	72	3 00	3 05	3 00

No. 55—SACRAMENTO.

GERMANIA BUILDING AND LOAN ASSOCIATION.

(Incorporated December 31, 1872.)

H. J. GOETHE, Secretary. CHAS. SCHMITT, President.

Fiscal year ends December 31, 1898.

No. of series, 9. No. of shares, 5,161.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$394,106 85	Installment stock—dues	$421,368 00
Arrearages		13,058 54	Earnings apportioned	113,665 34
On shares	$2,026 00		Advance payments	473 67
On interest	11,032 54		Reserve and undivided profits	28,543 02
Cash on hand and in bank		16,186 23		
Real estate owned		138,048 41		
Other assets		2,650 00		
Total assets		$564,050 03	Total liabilities	$564,050 03

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$17,415 87	Loans on mortgages and stock	$40,504 45
Installment stock—dues	70,804 00	Interest paid	646 64
Interest received	65,210 43	Dues repaid — installment stock	121,012 00
Fees received	18 75	Profits repaid — installment stock	18,680 58
Loans repaid	204,693 96	Salaries	3,000 00
All other receipts	9,742 83	Taxes	13,119 90
		Other expenses	2,485 41
		All other disbursements	152,250 63
		Balance on hand and in bank	16,186 23
Total receipts	$367,885 84	Total disbursements	$367,885 84

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
5	1,313	1,015	$144 00	$197 36	Fixed by Board of Directors.
6	1,331	1,121	108 00	140 89	
7	763	606	84 00	101 60	
8	565	450	72 00	84 17	
9	699	442	60 00	67 89	
10	731	349	48 00	52 63	
11	739	416	36 00	38 40	
12	562	287	24 00	25 00	
13	----------	475	12 00	12 22	

No. 56—SACRAMENTO.

OCCIDENTAL BUILDING AND LOAN ASSOCIATION.

(Incorporated February 7, 1881.)

P. B. JOHNSON, Secretary. A. J. JOHNSTON, President.

Fiscal year ends February 8, 1899.

No. of series, 12. No. of shares, 1,105.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$51,690 51	Installment stock—dues	$112,626 05
Arrearages		3,669 78	Overdrafts and bills payable	10,230 00
On shares	$2,383 00		Other liabilities	2,047 50
On interest	1,286 78			
Cash on hand and in bank		1,421 01		
Real estate owned		64,505 00		
Other assets		3,617 25		
Total assets		$124,903 55	Total liabilities	$124,903 55

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$4,963 52	Overdrafts and bills payable	$19,503 00
Installment stock—dues	13,097 00	Loans on mortgages and stock	8,010 00
Interest received	5,365 78	Interest paid	840 90
Fines received	2 50	Dues repaid — installment stock	18,708 85
Loans repaid	39,875 15	Salaries	720 00
Overdrafts and bills payable	7,103 00	Taxes	2,506 27
All other receipts	18,819 37	Other expenses	1,061 96
		All other disbursements	36,454 33
		Balance on hand and in bank	1,421 01
Total receipts	$89,226 32	Total disbursements	$89,226 32

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
8	160	145	$159 00	$140 36	
9	121	110	147 00	129 87	
10	396	329	135 00	119 39	
11	60	55	123 00	108 90	
12	70	60	111 00	98 42	
13	195	159	99 00	87 92	
14	20	20	84 00	74 82	
15	120	100	72 00	64 32	
16	60	40	60 00	53 84	
17	65	20	48 00	43 33	
18	62	37	36 00	32 85	
19	30	30	24 00	22 36	

No. 57—SACRAMENTO.

SACRAMENTO BUILDING AND LOAN ASSOCIATION.

(Incorporated August 26, 1874.)

FRANK HICKMAN, Secretary. M. BARBER, President.

Fiscal year ends August 31, 1898.

No. of series, 12. No. of shares, 2,652.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$204,364 55	Installment stock—dues	$170,628 00
Arrearages		6,855 80	Earnings apportioned	53,872 83
On shares	$2,036 00		Reserve and undivided profits	6,638 28
On interest	4,736 75		Other liabilities	423 00
On fines, etc.	83 05			
Cash on hand and in bank		3,034 36		
Real estate owned		16,813 02		
Other assets		494 38		
Total assets		$231,562 11	Total liabilities	$231,562 11

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$0 95	Overdrafts and bills payable	$3,562 39
Installment stock—dues	35,764 00	Loans on mortgages and stock	28,608 85
Interest received	21,931 30	Interest paid	1,495 60
Fines received	144 55	Dues repaid — installment stock	65,320 00
Fees received	10 30	Profits repaid — installment stock	17,762 61
Loans repaid	69,817 60	Salaries	1,200 00
All other receipts	54 65	Taxes	6,242 81
		Other expenses	259 40
		All other disbursements	237 33
		Balance on hand and in bank	3,034 36
Total receipts	$127,723 35	Total disbursements	$127,723 35

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
10	239	90	$134 00	$200 00	....
11	147	137	132 00	197 65	$187 77
12	216	216	120 00	173 06	164 41
13	216	136	108 00	150 06	142 56
14	221	211	96 00	128 47	122 05
15	267	209	84 00	108 36	102 95
16	395	265	72 00	89 57	85 10
17	208	86	60 00	71 98	68 39
18	237	203	48 00	55 49	52 72
19	597	421	36 00	40 15	38 15
20	562	399	24 00	25 83	24 54
21	....	279	12 00	12 47	12 00

No. 58—SALINAS.

SALINAS MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated September 2, 1897.)

W. H. CLARK, Secretary. R. L. PORTER, Vice-President.

Fiscal year ends September 11, 1898.

No. of series, 1. No. of shares, 910.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$5,900 00	Installment stock—dues	$5,460 00
Cash on hand and in bank	418 53	Earnings apportioned	145 60
Other assets	188 40	Overdrafts and bills payable	895 00
		Reserve and undivided profits	6 33
Total assets	$6,506 93	Total liabilities	$6,506 93

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$5,545 00	Loans on mortgages and stock	$5,900 00
Interest received	250 60	Interest paid	3 75
Fines received	10 50	Dues repaid — installment stock	85 00
Fees received	93 20	Salaries	140 00
Overdrafts and bills payable	895 00	Other expenses	249 57
All other receipts	2 55	Balance on hand and in bank	418 53
Total receipts	$6,796 85	Total disbursements	$6,796 85

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1		910	$6 00	$6 16	$6 00

No. 59—SAN BERNARDINO.

SANTA FE BUILDING AND LOAN ASSOCIATION.

(Incorporated January 8, 1890.)

JOHN FLAGG, Secretary. J. F. PARKER, President.

Fiscal year ends December 31, 1898.

No. of series, 9. No. of shares, 1,426.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$76,720 00	Installment stock—dues	$51,526 00
Arrearages		309 15	Paid-up and prepaid stock	12,200 00
On shares	$104 00		Earnings apportioned	15,592 43
On interest	158 40		Reserve and undivided profits	23 42
On fines, etc.	46 75		Other liabilities	424 75
Cash on hand and in bank		2,455 95		
Other assets		281 50		
Total assets		$79,766 60	Total liabilities	$79,766 60

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$404 45	Overdrafts and bills payable	$3,300 00
Installment stock—dues	16,661 00	Loans on mortgages and stock	25,945 25
Paid-up and prepaid stock	5,150 00	Interest paid	817 25
Interest received	7,847 55	Dues repaid — installment stock	8,558 00
Premiums, fines, and fees received	205 60	Profits repaid — installment stock	1,674 60
Loans repaid	17,690 00	Paid-up and prepaid stock	4,110 00
Overdrafts and bills payable	800 00	Salaries	500 00
All other receipts	2,072 10	Taxes	1,664 80
		Other expenses	177 10
		All other disbursements	1,627 75
		Balance on hand and in bank	2,455 95
Total receipts	$50,830 70	Total disbursements	$50,830 70

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Series.	Book Value per Series.	Withdrawal Value.
1	105	85	$8,925 00	$14,300 41	
2	65	60	5,630 00	8,415 69	
3	65	50	3,940 00	5,498 57	
4	54	54	3,695 00	4,905 43	Six
5	155	128	6,933 00	8,646 34	per cent
6	271	218	9,100 00	10,800 14	profit.
7	183	153	5,161 00	5,900 60	
8	350	250	4,827 00	5,209 95	
9	------------	428	3,315 00	3,441 30	

No. 60—SAN DIEGO.

SAN DIEGO BUILDING AND LOAN ASSOCIATION.

(Incorporated July 14, 1885.)

THEO. FINTZELBERG, Secretary. A. BLOCHMAN, President.

Fiscal year ends July 25, 1898.

No. of series, 8. No. of shares, 3,923.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$150,935 00	Installment stock—dues	$139,456 00
Arrearages		1,988 75	Earnings apportioned	27,995 43
On shares	$769 00		Advance payments	3,341 80
On interest	1,120 20		Reserve and undivided profits	4,858 61
On fines, etc.	99 55		Other liabilities	1,280 00
Cash on hand and in bank		9,145 59		
Real estate owned		14,450 00		
Other assets		412 50		
Total assets		$176,931 84	Total liabilities	$176,931 84

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$5,881 31	Loans on mortgages and stock	$23,467 20
Installment stock—dues	53,977 00	Interest paid	123 75
Interest received	16,246 93	Dues repaid — installment stock	46,227 00
Premiums received	2,248 50	Profits repaid — installment stock	14,914 81
Fines received	374 75	Salaries	1,200 00
Fees received	149 00	Taxes	3,208 79
Loans repaid	25,530 00	Other expenses	381 10
All other receipts	1,572 90	All other disbursements	7,312 15
		Balance on hand and in bank	9,145 59
Total receipts	$105,980 39	Total disbursements	$105,980 39

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	436	141	$98 00	$144 71	$121 76
5	249	146	83 00	112 60	100 01
6	200	200	71 00	90 65	83 42
7	287	274	59 00	71 72	67 55
8	614	594	47 00	54 99	52 40
9	769	678	35 00	39 16	37 97
10	1,172	893	23 00	24 80	24 26
11	------------	997	11 00	11 50	11 27

No. 61—SAN DIEGO.

SAN DIEGO SAVINGS AND LOAN ASSOCIATION.

(Incorporated November 11, 1887.)

OLIVER C. REED, Secretary. J. H. FRANCIS, Vice-President.

Fiscal year ends December 31, 1898.

No. of series, 9. No. of shares, 187.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$10,319 02	Installment stock—dues	$5,894 00
Arrearages		172 75	Earnings apportioned	711 62
On shares	$146 00		Advance payments	12 00
On interest	26 75		Overdrafts and bills payable	4,231 45
Cash on hand and in bank		12 30	Reserve and undivided profits	200 00
Real estate owned		515 00		
Other assets		30 00		
Total assets		$11,049 07	Total liabilities	$11,049 07

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$142 12	Overdrafts and bills payable	$1,950 00
Installment stock—dues	3,411 00	Dues repaid — installment stock	14,357 00
Interest received	1,235 78	Profits repaid — installment stock	5,907 30
Loans repaid	12,340 10	Salaries	540 00
Overdrafts and bills payable	5,731 45	Taxes	323 20
All other receipts	590 00	Other expenses	30 45
		All other disbursements	330 20
		Balance on hand and in bank	12 30
Total receipts	$23,450 45	Total disbursements	$23,450 45

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	8	8	$100 00	$135 00	$118 33
6	24	5	66 00	78 36	73 42
8	31	26	46 00	51 22	49 35
9	68	28	40 00	44 49	42 33
10	41	15	34 00	36 37	35 29
11	36	21	28 00	29 63	28 74
12	27	24	22 00	22 86	22 25
13	52	37	16 00	16 33	16 10
14		23	10 00	10 25	10 00

No. 62—SAN DIEGO.

SILVER GATE BUILDING AND LOAN ASSOCIATION.

(Incorporated May 22, 1890.)

J. D. Wood, Secretary. L. F. Doolittle, President.

Fiscal year ends May 31, 1899.

No. of series, 8, No. of shares, 445.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$20,814 00	Installment stock—dues	$20,585 00
Arrearages		489 70	Paid-up and prepaid stock	1,000 00
On shares	$154 00		Earnings apportioned	6,295 05
On interest	267 15		Advance payments	10 00
On fines, etc.	68 55		Reserve and undivided profits	2 54
Cash on hand and in bank		3,765 82	Other liabilities	200 00
Real estate owned		2,860 00		
Other assets		163 07		
Total assets		$28,092 59	Total liabilities	$28,092 59

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$594 63	Loans on mortgages and stock	$2,177 50
Installment stock—dues	5,445 00	Dues repaid — installment stock	2,855 00
Interest received	1,795 19	Profits repaid — installment stock	366 12
Premiums received	189 00	Salaries	300 00
Fines received	55 85	Taxes	371 68
Fees received	8 30	Other expenses	148 78
Loans repaid	1,792 00	All other disbursements	44 25
All other receipts	149 18	Balance on hand and in bank	3,765 82
Total receipts	$10,029 15	Total disbursements	$10,029 15

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	53	46	$108 00	$179 00	$137 16
2	57	52	77 00	102 77	91 82
3	55	50	60 00	74 02	69 00
4	67	52	48 00	56 02	53 76
5	36	31	36 00	40 24	39 24
6	171	142	27 00	29 51	28 82
7	63	44	21 00	22 66	22 10
8	-----------	27	9 00	9 41	9 20

No. 63—SAN FRANCISCO.

ACME BUILDING AND LOAN ASSOCIATION.

(Incorporated March 14, 1891.)

A. CALMANN, Secretary. D. DAVIS, President.

Fiscal year ends February 16, 1899.

No. of series, 14. No. of shares, 634.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$29,550 00	Installment stock—dues	$39,445 00
Arrearages		440 80	Earnings apportioned	7,501 65
On shares	$188 00		Reserve and undivided profits	3,004 10
On interest	177 00			
On premiums	75 80			
Cash on hand and in bank		1,317 44		
Real estate owned		18,522 51		
Other assets		120 00		
Total assets		$49,950 75	Total liabilities	$49,950 75

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$287 35	Overdrafts and bills payable	$1,071 27
Installment stock—dues	7,459 00	Loans on mortgages and stock	6,650 00
Interest received	1,866 30	Interest paid	35 23
Premiums received	720 30	Dues repaid — installment stock	3,467 00
Fines received	13 20	Profits repaid — installment stock	300 69
Fees received	7 60	Salaries	600 00
Loans repaid	5,700 00	Taxes	228 13
All other receipts	571 20	Other expenses	211 09
		All other disbursements	2,744 10
		Balance on hand and in bank	1,317 44
Total receipts	$16,624 95	Total disbursements	$16,624 95

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	210	180	$96 00	$118 33	$107 16
2	125	125	89 00	107 52	98 26
3	30	30	84 00	99 89	91 94
4	15	15	78 00	91 39	84 69
5	10	10	72 00	83 15	77 57
6	5				
7	5	5	60 00	66 97	63 48
8	10	10	54 00	59 68	56 84
9	18	10	48 00	52 62	50 31
11	8	8	36 00	38 48	37 24
12	57	55	30 00	31 72	30 86
13	106	95	24 00	25 10	24 55
14	42	27	18 00	18 51	18 25
15		37	12 00	12 17	12 08
16		27	6 00	6 05	6 02

No. 64—SAN FRANCISCO.

ÆTNA MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated May 18, 1893.)

N. Schlesinger, Secretary. August Drucker, President.

Fiscal year ends May 31, 1899.

No. of series, 6. No. of shares, 816.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$40,000 00	Installment stock—dues	$39,804 00
Arrearages		4,745 53	Earnings apportioned	8,872 53
On shares	$2,249 00		Overdrafts and bills payable	2,191 78
On interest	2,496 53			
Real estate owned		6,084 98		
Other assets		37 80		
Total assets		$50,868 31	Total liabilities	$50,868 31

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,508 10	Loans on mortgages and stock	$10,200 00
Installment stock—dues	9,598 00	Interest paid	172 74
Interest received	1,421 87	Dues repaid — installment stock	15,690 00
Premiums received	150 00	Profits repaid — installment stock	1,696 81
Fees received	17 10	Salaries	1,028 00
Loans repaid	15,850 00	Taxes	615 57
Overdrafts and bills payable	2,191 78	Other expenses	85 83
All other receipts	330 00	All other disbursements	2,577 90
Total receipts	$32,066 85	Total disbursements	$32,066 85

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	518	370	$72 00	$91 01	$82 45
2	124	39	60 00	73 24	65 96
3	66	56	48 00	56 51	50 98
4	142	117	36 00	40 82	37 20
5	148	93	24 00	26 17	24 33
6	-----	141	12 00	12 56	12 03

No. 65—SAN FRANCISCO.

ALLIANCE BUILDING AND LOAN ASSOCIATION.

(Incorporated October 14, 1890.)

A. CALMANN, Secretary. G. H. UMBSEN, President.

Fiscal year ends October 20, 1898.

No. of series, 12. No. of shares, 581.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$41,200 00	Installment stock—dues	$39,462 00
Arrearages		235 35	Earnings apportioned	8,754 62
On shares	$157 00		Advance payments	800 40
On interest	54 85		Overdrafts and bills payable	4,996 92
On premiums	23 50		Reserve and undivided profits	2,652 73
Cash on hand and in bank		22 42	Unearned premiums	925 75
Real estate owned		16,134 65		
Total assets		$57,592 42	Total liabilities	$57,592 42

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$448 17	Overdrafts and bills payable	$10,578 83
Installment stock—dues	7,331 00	Loans on mortgages and stock	1,300 00
Interest received	3,158 90	Interest paid	687 93
Premiums received	813 85	Dues repaid — installment stock	3,730 00
Fines received	6 00	Profits repaid — installment stock	530 16
Fees received	2 90	Salaries	1,030 00
Loans repaid	1,881 10	Taxes	407 48
Overdrafts and bills payable	4,996 92	Other expenses	365 85
All other receipts	678 25	All other disbursements	664 42
		Balance on hand and in bank	22 42
Total receipts	$19,317 09	Total disbursements	$19,317 09

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	350	305	$96 00	$120 91	$110 95
2	20	20	90 00	111 27	100 64
5	20	10	72 00	84 70	78 35
6	19	19	66 00	76 15	71 08
8	25	25	54 00	59 76	56 88
9	23	23	48 00	52 38	50 19
10	13	13	42 00	45 39	43 70
11	15	15	36 00	38 07	37 03
12	8	8	30 00	31 58	30 79
13	80	55	24 00	24 92	24 46
14	77	65	18 00	18 41	18 20
16	----------	23	6 00	6 09	6 04

No. 66—SAN FRANCISCO.

ATLAS BUILDING AND LOAN ASSOCIATION.

(Incorporated October 14, 1890.)

N. SCHLESINGER, Secretary. CHAS. HARRIS, President.

Fiscal year ends September 30, 1898.

No. of series, 8. No. of shares, 1,184.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$60,700 00	Installment stock—dues	$84,816 00
Arrearages		9,815 73	Earnings apportioned	17,647 01
On shares	$5,652 00		Reserve and undivided profits	7,189 22
On interest	4,163 73			
Cash on hand and in bank		6,593 03		
Real estate owned		32,454 47		
Other assets		89 00		
Total assets		$109,652 23	Total liabilities	$109,652 23

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$7,296 69	Interest paid	$36 72
Installment stock—dues	12,644 00	Dues repaid — installment stock	15,194 00
Interest received	1,592 51	Profits repaid — installment stock	1,311 50
Fees received	12 00	Salaries	1,462 50
Loans repaid	3,400 00	Taxes	903 79
All other receipts	1,047 00	Other expenses	143 68
		All other disbursements	346 98
		Balance on hand and in bank	6,593 03
Total receipts	$25,992 20	Total disbursements	$25,992 20

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	550	500	$96 00	$119 10	$107 55
2	236	140	84 00	101 71	91 08
3	180	154	72 00	85 04	75 91
4	98	88	60 00	69 08	61 82
5	84	84	48 00	53 83	48 54
6	132	72	36 00	39 30	36 00
7	26	26	24 00	25 49	24 00
8	------------	20	12 00	12 39	12 00

No. 67—SAN FRANCISCO.

ALTA BUILDING AND LOAN ASSOCIATION.

(Incorporated February, 1891.)

SOL J. LEVY, Secretary. JULIUS JACOBS, President.

Fiscal year ends February 28, 1899.

No. of series, 9. No. of shares, 372.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$21,800 00	Installment stock—dues	$32,622 00
Arrearages		833 05	Earnings apportioned	3,686 95
On shares	$455 00		Reserve and undivided profits	5,538 88
On interest	345 05		Unearned premiums	2,874 46
On premiums	33 00		Other liabilities	60 00
Cash on hand and in bank		2,495 90		
Real estated owned		18,042 00		
Other assets		1,611 34		
Total assets		$44,782 29	Total liabilities	$44,782 29

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$723 90	Dues repaid — installment stock	$14,231 00
Installment stock—dues	5,509 00	Profits repaid — installment stock	309 20
Interest received	1,978 72	Salaries	812 50
Premiums received	246 00	Taxes	481 98
Fees received	50	Other expenses	53 00
Loans repaid	9,776 00	All other disbursements	842 45
All other receipts	991 91	Balance on hand and in bank	2,495 90
Total receipts	$19,226 03	Total disbursements	$19,226 03

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	285	247	$96 00	$108 40	$97 50
2	73	45	90 00	99 70	90 00
3	35	5	84 00	95 19	84 00
5	100	25	72 00	75 04	72 00
6	25	15	66 00	68 50	66 00
7	15	15	60 00	61 68	60 00
8	5	5	54 00	55 32	54 00
9	5				
10	15	10	42 00	42 64	42 00
11	15				
12		5	12 00	12 00	12 00

No. 68—SAN FRANCISCO.

ARGONAUT MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated January 31, 1891.)

E. GUNZBURGER, Secretary. GEO. W. DIXON, President.

Fiscal year ends February 12, 1899.

No. of series, 8. No. of shares, 770.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$42,250 00	Installment stock—dues	$47,676 00
Arrearages		1,871 90	Earnings apportioned	11,021 97
On shares	$684 00		Advance payments	279 35
On interest	863 00		Reserve and undivided profits	2,483 35
On premiums	324 90		Other liabilities	230 00
Cash on hand and in bank		2,396 20		
Real estate owned		15,127 32		
Other assets		45 25		
Total assets		$61,690 67	Total liabilities	$61,690 67

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,991 05	Loans on mortgages and stock	$11,150 00
Installment stock—dues	12,022 00	Interest paid	13 28
Interest received	4,119 30	Dues repaid — installment stock	18,549 00
Premiums received	1,894 15	Profits repaid — installment stock	3,427 99
Fines received	364 57	Salaries	1,096 00
Fees received	12 20	Taxes	745 51
Loans repaid	20,100 00	Other expenses	254 39
All other receipts	5,779 02	All other disbursements	10,649 92
		Balance on hand and in bank	2,396 20
Total receipts	$48,282 29	Total disbursements	$48,282 29

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	284	159	$96 00	$123 87	$112 72
2	182	167	84 00	105 37	94 68
3	153	101	72 00	87 73	79 86
4	83	56	60 00	70 95	64 93
5	84	73	48 00	55 04	50 82
6	28	14	36 00	40 00	37 20
7	130	112	24 00	25 80	24 54
8	------------	88	12 00	12 55	12 17

No. 69—SAN FRANCISCO.

BAY CITY BUILDING AND LOAN ASSOCIATION.

(Incorporated May 9, 1889.)

E. GUNZBURGER, Secretary. W. H. BREMER, President.

Fiscal year ends May 21, 1899.

No. of series, 9. No. of shares, 852.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$75,050 00	Installment stock—dues	$66,696 00
Arrearages		4,272 20	Earnings apportioned	21,176 91
On shares	$2,311 00		Reserve and undivided profits	2,789 42
On interest	1,293 75		Other liabilities	655 20
On premiums	667 45			
Cash on hand and in bank		5,057 08		
Real estate owned		6,831 00		
Other assets		107 25		
Total assets		$91,317 53	Total liabilities	$91,317 53

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,967 72	Loans on mortgages and stock	$8,400 00
Installment stock—dues	9,816 00	Interest paid	49 49
Interest received	4,470 80	Dues repaid — installment stock	15,848 00
Premiums received	1,750 18	Profits repaid — installment stock	4,180 89
Fines received	8 00	Salaries	1,292 50
Fees received	10 90	Taxes	929 61
Loans repaid	12,550 00	Other expenses	293 08
All other receipts	5,080 35	All other disbursements	603 30
		Balance on hand and in bank	5,057 08
Total receipts	$36,653 95	Total disbursements	$36,653 95

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	449	344	$120 00	$163 96	$157 36
2	116	88	108 00	143 64	132 95
3	67	67	96 00	124 19	112 91
4	17	5	84 00	105 62	96 97
6	5	5	60 00	71 08	65 54
7	50	50	48 00	55 12	51 56
8	72	61	36 00	40 03	38 02
9	139	115	24 00	25 82	24 91
10	------------	117	12 00	12 47	12 24

No. 70—SAN FRANCISCO.

CALIFORNIA MUTUAL SAVINGS FUND, LOAN, AND BUILDING ASSOCIATION.

(Incorporated March 26, 1887.)

WILLIAM E. LUTZ, Secretary. E. L. HEAD, President.

Fiscal year ends March 31, 1899.

No. of series, 20. No. of shares, 845.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$74,175 00	Installment stock—dues	$48,912 00
Arrearages		1,366 46	Earnings apportioned	17,076 88
On shares	$812 00		Advance payments	16 00
On interest	449 71		Overdrafts and bills payable	11,876 26
On premiums	104 75		Reserve and undivided profits	2,000 36
Real estate owned		9,600 00	Unearned premiums	3,554 43
Other assets		10 00	Other liabilities	1,715 53
Total assets		$85,151 46	Total liabilities	$85,151 46

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$10,275 00	Overdrafts and bills payable	$12,868 30
Interest received	6,025 67	Loans on mortgages and stock	10,850 00
Premiums received	1,223 05	Interest paid	1,038 50
Fines received	167 70	Dues repaid — installment stock	9,745 00
Fees received	16 50	Profits repaid — installment stock	3,922 82
Loans repaid	15,000 00	Salaries	852 50
Overdrafts and bills payable	8,876 26	Taxes	787 79
All other receipts	933 81	Other expenses	108 13
		All other disbursements	2,344 95
Total receipts	$42,517 99	Total disbursements	$42,517 99

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	28	28	$126 00	$199 76	Varies with age.
5	65	65	120 00	184 98	
6	72	52	114 00	170 88	
7	18	14	108 00	157 50	
8	37	37	102 00	144 64	
9	8	8	96 00	132 66	
10	35	35	90 00	121 11	
11	80	66	84 00	110 15	
12	35	28	78 00	99 77	
13	18	14	72 00	89 88	
14	33	33	66 00	80 46	
15	3	3	60 00	71 54	
17	36	35	48 00	54 97	
18	61	61	42 00	47 23	
19	52	47	36 00	39 77	
20	51	51	30 00	32 58	
21	54	54	24 00	25 68	
22	59	59	18 00	19 03	
23	----------	101	12 00	12 49	
24	----------	54	6 00	6 13	

No. 71—SAN FRANCISCO.

CAPITAL BUILDING AND LOAN ASSOCIATION.

(Incorporated June 10, 1890.)

W. H. DAVIS, Secretary. JOSEPH FIGEL, Vice-President.

Fiscal year ends May 31, 1899.

No. of series, 28. No. of shares, 840.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$50,230 00	Installment stock—dues	$38,843 00
Arrearages		2,584 99	Earnings apportioned	15,271 44
On shares	$1,172 00		Overdrafts and bills payable	11,015 93
On interest	1,007 74		Reserve and undivided profits	1,693 72
On premiums	405 25			
Real estate owned		13,919 10		
Other assets		90 00		
Total assets		$66,824 09	Total liabilities	$66,824 09

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$8,318 00	Overdrafts and bills payable	$2,393 79
Interest received	3,779 46	Loans on mortgages and stock	12,600 00
Premiums received	1,424 13	Interest paid	417 96
Fines received	112 66	Dues repaid—installm't stock	13,620 00
Fees received	9 30	Profits repaid—installm't st'k	4,590 30
Loans repaid	17,110 00	Salaries	960 00
Overdrafts and bills payable	11,015 93	Taxes	659 44
All other receipts	4,769 03	Other expenses	84 00
		All other disbursements	11,213 02
Total receipts	$46,538 51	Total disbursements	$46,538 51

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	215	100	$108 00	$171 02	$137 40
2	30	30	105 00	163 67	132 80
3	45	45	99 00	149 01	123 75
4	20	5	96 00	141 99	119 28
5	60	24	93 00	135 43	114 85
6	20	20	88 00	124 81	107 15
7	15	15	84 00	116 81	101 85
8	7	5	81 00	111 08	97 61
9	5	5	78 00	105 47	93 45
10	11	6	75 00	100 00	89 25
14	25	15	63 00	79 42	73 08
15	32	25	60 00	74 64	69 15
17	30	30	54 00	65 42	61 42
18	72	37	51 00	60 96	57 63
19	15	------	------	------	------
20	30	10	45 00	52 49	50 17
21	2	2	42 00	48 48	46 51
22	50	35	39 00	44 53	42 90
23	24	24	36 00	40 70	39 33
24	57	13	33 00	36 95	35 80
25	21	11	30 00	33 30	32 32
26	25	25	27 00	29 71	28 89
27	10	10	24 00	26 22	25 50
29	20	10	18 00	19 38	18 85
30	61	10	15 00	16 01	15 60
31	------	130	12 00	12 67	12 39
32	------	57	9 00	9 37	9 22
33	------	82	6 00	6 17	6 10
34	------	59	3 00	3 04	3 00

No. 72—SAN FRANCISCO.

CITY BUILDING AND LOAN ASSOCIATION.

(Incorporated March 26, 1891.)

J. M. Ellis, Secretary. Wm. H. Bremer, President.

Fiscal year ends March 31, 1899.

No. of series, 8. No. of shares, 1,004½.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$58,550 00	Installment stock—dues	$63,252 00
Arrearages		613 05	Earnings apportioned	14,731 79
On shares	$326 00		Overdrafts and bills payable	3,475 82
On interest	273 55		Reserve and undivided profits	3,324 13
On premiums	13 50		Unearned premiums	417 36
Cash on hand and in bank		194 55		
Real estate owned		25,795 50		
Other assets		48 00		
Total assets		$85,201 10	Total liabilities	$85,201 10

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$0 50	Overdrafts and bills payable	$2,529 97
Installment stock—dues	12,460 00	Loans on mortgages and stock	7,750 00
Interest received	3,971 50	Interest paid	453 44
Premiums received	402 00	Dues repaid — installment stock	9,799 00
Fines received	47 50	Profits repaid—installment stock	1,093 96
Fees received	11 40	Salaries	1,315 00
Loans repaid	2,700 00	Taxes	464 51
Overdrafts and bills payable	3,475 82	Other expenses	96 43
All other receipts	3,205 03	All other disbursements	2,576 89
		Balance on hand and in bank	194 55
Total receipts	$26,273 75	Total disbursements	$26,273 75

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	380	330	$96 00	$124 71	Dues and 6%.
2	115	110	90 00	114 52	
4	102	87	72 00	85 69	
5	93	84	60 00	68 95	
6	93	63	48 00	52 74	
7	105	65	36 00	38 34	
8	194½	151½	24 00	24 92	
9	----------	114	12 00	12 24	

No. 73—SAN FRANCISCO.

CITIZENS BUILDING AND LOAN ASSOCIATION.

(Incorporated January 14, 1885.)

FREMONT WOOD, Secretary. T. M. GARDINER, President.

Fiscal year ends February 28, 1899.

No. of series, 41. No. of shares, 8,926.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$478,274 34	Installment stock—dues	$430,128 00
Arrearages		18,159 77	Earnings apportioned	133,832 97
On shares	$6,263 00		Advance payments	1,828 00
On interest	6,868 25		Reserve and undivided profits	12,456 74
On premiums	3,172 27		Other liabilities	10,640 97
On fines, etc.	1,856 25			
Cash on hand and in bank		23,795 21		
Real estate owned		68,053 37		
Other assets		603 99		
Total assets		$588,886 68	Total liabilities	$588,886 68

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$548 84	Overdrafts and bills payable	$198,700 00
Installment stock—dues	108,451 00	Loans on mortgages and stock	48,726 90
Interest received	34,233 47	Interest paid	2,202 45
Premiums received	13,973 58	Dues repaid — installment stock	123,074 00
Fines received	902 20	Profits repaid — installment stock	51,816 40
Fees received	140 20	Salaries	2,460 00
Loans repaid	133,873 65	Taxes	7,722 79
Overdrafts and bills payable	198,700 00	Other expenses	2,462 16
All other receipts	23,822 55	All other disbursements	53,695 58
		Balance on hand and in bank	23,795 21
Total receipts	$514,655 49	Total disbursements	$514,655 49

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
120	$120 00	$191 20	$191 20
114	114 00	176 54	153 68
108	108 00	162 49	143 25
102	102 00	149 31	133 12
96	96 00	136 92	123 29
90	90 00	125 32	113 74
84	84 00	113 82	104 48
78	78 00	102 96	95 49
72	72 00	92 67	86 76
66	66 00	82 74	78 29
60	60 00	73 25	69 15
54	54 00	64 23	61 42
48	48 00	55 87	53 88
42	42 00	47 92	46 51
36	36 00	40 49	39 33
30	30 00	33 09	32 32
24	24 00	26 01	25 50
18	18 00	19 15	18 85
12	12 00	12 54	12 39
6	6 00	6 15	6 10

No. 74—SAN FRANCISCO.

COLUMBIA BUILDING AND LOAN ASSOCIATION.

(Incorporated May 2, 1890.)

E. GUNZBURGER, Secretary. S. ZEMANSKY, President.

Fiscal year ends May 10, 1899.

No. of series, 6. No. of shares, 488.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$17,000 00	Installment stock—dues	$41,184 00
Arrearages		11,162 40	Advance payments	5 00
On shares	$10,797 00		Overdrafts and bills payable	6,052 82
On interest	255 90		Reserve and undivided profits	18,626 34
On premiums	109 50		Other liabilities	102 00
Real estate owned		37,802 76		
Other assets		5 00		
Total assets		$65,970 16	Total liabilities	$65,970 16

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$3,215 00	Overdrafts and bills payable	$8,280 22
Interest received	1,514 25	Interest paid	514 92
Premiums received	648 40	Dues repaid — installment stock	6,044 00
Fines received	9 00	Salaries	780 00
Loans repaid	8,850 00	Taxes	438 34
Overdrafts and bills payable	3,052 82	Other expenses	151 40
All other receipts	2,714 75	All other disbursements	3,795 34
Total receipts	$20,004 22	Total disbursements	$20,004 22

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	137	111	$108 00	$108 00	$108 00
2	40	40	96 00	96 00	96 00
3	136	101	84 00	84 00	84 00
4	54	54	78 00	78 00	78 00
5	205	145	72 00	72 00	72 00
6	62	37	60 00	60 00	60 00

No. 75—SAN FRANCISCO.

COMMERCIAL BUILDING AND LOAN ASSOCIATION.

(Incorporated December 21, 1886.)

CHARLES K. CLARK, Secretary. T. G. COCKRILL, Vice-President.

Fiscal year ends December 31, 1898.

No. of series, 21. No. of shares, 1,581.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$103,900 00	Installment stock—dues	$79,656 00
Arrearages		3,022 30	Earnings apportioned	26,831 75
On shares	$1,029 00		Advance payments	44 00
On interest	1,100 00		Overdrafts and bills payable	3,962 85
On premiums	507 20		Reserve and undivided profits	5,104 95
On fines, etc.	386 10		Other liabilities	16,531 95
Real estate owned		24,992 45		
Other assets		216 75		
Total assets		$132,131 50	Total liabilities	$132,131 50

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$21,184 00	Overdrafts and bills payable	$17,938 78
Interest received	8,319 00	Loans on mortgages and stock	9,620 80
Premiums received	3,346 45	Interest paid	1,298 72
Fines received	197 35	Dues repaid — installment stock	37,183 00
Fees received	43 00	Profits repaid — installment stock	17,804 80
Loans repaid	49,480 00	Salaries	1,060 00
Overdrafts and bills payable	3,962 85	Taxes	1,339 16
All other receipts	38,990 70	Other expenses	265 79
		All other disbursements	39,012 30
Total receipts	$125,523 35	Total disbursements	$125,523 35

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	30	30	$126 00	$197 30	$196 30
3	42	32	120 00	186 05	185 05
4	20	16	114 00	173 70	172 70
5	40	15	108 00	161 80	160 80
6	87	75	102 00	149 65	147 65
7	55	50	96 00	138 50	136 50
8	64	54	90 00	127 00	123 00
9	140	104	84 00	116 10	113 10
10	94	94	78 00	105 65	101 65
11	64	59	72 00	95 80	91 80
12	34	30	66 00	86 00	81 00
13	80	71	60 00	76 50	71 50
14	74	74	54 00	67 20	61 40
15	88	87	48 00	58 55	53 80
16	63	63	42 00	50 10	46 50
17	158	130	36 00	42 00	39 35
18	44	24	30 00	34 15	32 30
19	171	136	24 00	26 70	25 50
20	197	141	18 00	19 55	18 85
21		155	12 00	12 70	12 40
22		141	6 00	6 20	6 10

No. 76—SAN FRANCISCO.

COMMONWEALTH MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated July 26, 1889.)

J. B. Harries, Secretary. W. Matthews, Vice-President.

Fiscal year ends August 31, 1898.

No. of series, 14. No. of shares, 311½.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$34,040 00	Installment stock—dues	$22,080 00
Arrearages		851 83	Paid-up and prepaid stock	15,500 00
On shares	$514 00		Earnings apportioned	6,226 06
On interest	260 28		Overdrafts and bills payable	1,800 00
On premiums	77 55		Reserve and undivided profits	803 29
Cash on hand and in bank		688 49		
Real estate owned		10,499 83		
Other assets		329 20		
Total assets		$46,409 35	Total liabilities	$46,409 35

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$285 22	Overdrafts and bills payable	$1,178 00
Installment stock—dues	3,704 00	Loans on mortgages and stock	300 00
Paid-up and prepaid stock	1,000 00	Interest paid — borrowed money and full-paid stock	1,227 47
Interest received	2,807 58	Dues repaid — installment stock	3,704 00
Premiums received	435 10	Profits repaid — installment stock	608 40
Fines received	55 00	Paid-up and prepaid stock	650 00
Fees received	1 00	Salaries	755 00
Loans repaid	2,350 00	Taxes	606 29
All other receipts	575 40	Other expenses	240 99
		All other disbursements	1,254 66
		Balance on hand and in bank	688 49
Total receipts	$11,213 30	Total disbursements	$11,213 30

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	90½	90½	$108 00	$148 20	$137 16
2	21	1	102 00	136 10	128 01
3	51	46	96 00	124 73	119 04
7	22	22	84 00	104 91	101 64
11	8	8	69 00	82 68	80 90
12	17	17	66 00	78 48	76 89
13	23	18	60 00	70 08	69 00
14	25	17	54 00	61 99	61 29
17	16	16	39 00	42 50	42 80
18	40	10	36 00	38 69	39 24
19	15	15	30 00	31 64	32 25
20	46	26	24 00	24 89	25 44
21	5	5	18 00	18 39	18 81
22		20	6 00	6 04	6 09

No. 77—SAN FRANCISCO.

COSMOS LOAN ASSOCIATION.

(Incorporated April 30, 1890.)

J. S. HOPKINS, Secretary. JONATHAN CURTIS, President.

Fiscal year ends May 18, 1899.

No. of series, 16. No. of shares, 309½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$23,150 00	Installment stock—dues	$22,230 00
Arrearages		2,232 08	Earnings apportioned	5,801 52
On shares	$837 00		Reserve and undivided profits	3,604 59
On interest	976 58		Other liabilities	489 00
On premiums	418 50			
Cash on hand and in bank		904 92		
Real estate owned		5,781 56		
Other assets		56 55		
Total assets		$32,125 11	Total liabilities	$32,125 11

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$15,862 16	Loans on mortgages and stock	$350 00
Installment stock—dues	5,008 00	Dues repaid — installment stock	17,159 00
Interest received	1,720 45	Profits repaid — installment stock	4,100 70
Premiums received	553 40	Salaries	300 00
Fines received	37 98	Taxes	358 74
Fees received	5 50	Other expenses	43 28
Loans repaid	2,400 00	All other disbursements	2,778 85
All other receipts	408 00	Balance on hand and in bank	904 92
Total receipts	$25,995 49	Total disbursements	$25,995 49

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	170	70	$108 00	$142 10	$137 00
2	42	42	102 00	132 45	127 88
3	79	29	96 00	122 90	118 86
4	28	18	90 00	113 70	105 40
5	20	13	84 00	104 64	97 41
6	5	5	78 00	95 80	87 79
7	5	5	72 00	87 16	80 33
8	10	10	66 00	78 75	71 74
10	10	10	54 00	62 55	57 85
11	17	5	48 00	54 74	50 35
13	55	55	36 00	39 80	36 95
14	5	5	30 00	32 65	30 53
15	42½	7½	24 00	25 70	24 34
16	10	5	18 00	18 94	18 19
17		20	12 00	12 42	12 08
18		10	6 00	6 10	6 00

No. 78—SAN FRANCISCO.

ECONOMY BUILDING AND LOAN ASSOCIATION.

(Incorporated December 31, 1889.)

T. M. GARDINER, Secretary pro tem. H. C. BUNKER, Vice-President.

Fiscal year ends February 28, 1899.

No. of series, 23. No. of shares, 814.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$60,500 00	Installment stock—dues	$41,463 00
Arrearages		921 96	Earnings apportioned	17,481 77
On shares	$395 00		Advance payments	242 64
On interest	526 96		Overdrafts and bills payable	2,600 00
Cash on hand and in bank		235 95	Reserve and undivided profits	750 00
Real estate owned		2,542 25	Unearned premiums	1,412 75
			Other liabilities	250 00
Total assets		$64,200 16	Total liabilities	$64,200 16

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$5,639 28	Overdrafts and bills payable	$5,400 00
Installment stock—dues	9,843 00	Loans on mortgages and stock	6,000 00
Interest received	4,490 01	Interest paid	87 91
Premiums received	713 67	Dues repaid — installment stock	19,092 00
Fines received	67 80	Profits repaid — installment stock	8,954 47
Fees received	18 90	Salaries	735 00
Loans repaid	12,500 00	Taxes	578 64
Overdrafts and bills payable	8,000 00	Other expenses	154 94
All other receipts	817 21	All other disbursements	850 96
		Balance on hand and in bank	235 95
Total receipts	$42,089 87	Total disbursements	$42,089 87

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	291	130	$108 00	$169 74	
2	27	27	105 00	163 40	
3	30	30	102 00	157 10	
4	19	19	99 00	151 06	
5	15				
6	24	24	93 00	138 85	
7	40	40	90 00	132 95	
12	10	10	63 00	84 15	
16	26	20	48 00	60 34	
17	10	10	45 00	55 86	
18	35	30	42 00	51 47	Dues paid with 6% interest.
19	12	5	39 00	47 18	
20	73	73	36 00	42 99	
21	60	45	33 00	38 88	
22	86	81	30 00	34 88	
23	17	17	27 00	30 97	
24	22	17	24 00	27 15	
25	50	50	21 00	23 42	
26	45	5	18 00	19 79	
27	47	17	15 00	16 26	
28		58	12 00	12 82	
29		80	9 00	9 47	
30		7	6 00	6 22	
31		19	3 00	3 06	

No. 79—SAN FRANCISCO.

EINTRACHT SPAR UND BAU VEREIN.

(Incorporated July 12, 1884.)

HENRY GILLE, Secretary. F. HUFSCHMIDT, President.

Fiscal year ends June 30, 1898.

No. of series, 9. No. of shares, 1,911.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$81,275 00	Installment stock—dues	$78,210 00
Arrearages		10,389 60	Earnings apportioned	13,111 80
On shares	$6,387 00		Advance payments	419 80
On interest	4,002 60		Reserve and undivided profits	1,576 07
Cash on hand and in bank		1,205 54	Other liabilities	299 70
Real estate owned		600 00		
Other assets		147 23		
Total assets		$93,617 37	Total liabilities	$93,617 37

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$25,334 00	Overdrafts and bills payable	$560 37
Interest received	6,937 80	Loans on mortgages and stock	20,550 00
Fines received	142 35	Interest paid	72 55
Fees received	33 25	Dues repaid — installment stock	45,255 00
Loans repaid	47,595 00	Profits repaid — installment stock	10,351 72
Overdrafts and bills payable	500 00	Salaries	600 00
All other receipts	446 70	Taxes	1,454 26
		Other expenses	180 93
		All other disbursements	758 73
		Balance on hand and in bank	1,205 54
Total receipts	$80,989 10	Total disbursements	$80,989 10

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
8	488	Matured.			
9	339	319	$72 00	$89 07	$83 38
10	193	193	60 00	71 88	65 94
11	462	427	48 00	55 64	50 54
12	238	216	36 00	40 32	37 08
13	137	137	30 00	33 02	30 50
14	279	219	24 00	25 95	24 32
15	365	250	18 00	19 11	18 00
16	------------	104	12 00	12 51	12 00
17	------------	46	6 00	6 15	6 00

No. 80—SAN FRANCISCO.

EL DORADO LOAN ASSOCIATION.

(Incorporated March 14, 1890.)

E. GUNZBURGER, Secretary. GEO. W. DIXON, President.

Fiscal year ends March 15, 1899.

No. of series, 7. No. of shares, 805.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$40,250 00	Installment stock—dues	$73,476 00
Arrearages		19,271 90	Advance payments	65 00
On shares	$16,354 00		Reserve and undivided profits	12,467 22
On interest	2,828 65			
On premiums	89 25			
Cash on hand and in bank		81 82		
Real estate owned		25,500 00		
Other assets		904 50		
Total assets		$86,008 22	Total liabilities	$86,008 22

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$4,938 00	Overdrafts and bills payable	$302 58
Interest received	1,978 05	Loans on mortgages and stock	2,050 00
Premiums received	427 50	Interest paid	40 93
Fees received	30	Dues repaid — installment stock	11,812 00
Loans repaid	7,700 00	Salaries	780 00
All other receipts	4,811 60	Taxes	703 65
		Other expenses	252 19
		All other disbursements	3,832 28
		Balance on hand and in bank	81 82
Total receipts	$19,855 45	Total disbursements	$19,855 45

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	480	360	$108 00	$108 00	$108 00
2	95	75	96 00	96 00	96 00
3	142	123	84 00	84 00	84 00
4	222	219	72 00	72 00	72 00
5	15	15	60 00	60 00	60 00
7	13	10	36 00	36 00	36 00
8	-------	3	12 00	12 00	12 00

No. 81—SAN FRANCISCO.

EMPIRE BUILDING AND LOAN ASSOCIATION.

(Incorporated August 24, 1889.)

WM. E. LUTZ, Secretary. MARION LEVENTRITT, President.

Fiscal year ends August 31, 1898.

No. of series, 9. No. of shares, 1,218.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$127,625 00	Installment stock—dues	$95,568 00
Arrearages		865 85	Earnings apportioned	33,969 67
On shares	$438 00		Advance payments	396 26
On interest	427 85		Reserve and undivided profits	5,000 00
Cash on hand and in bank		3,313 04	Unearned premiums	159 00
Real estate owned		4,349 04	Other liabilities	1,060 00
Total assets		$136,152 93	Total liabilities	$136,152 93

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$14,720 00	Overdrafts and bills payable	$241 31
Interest received	8,634 45	Loans on mortgages and stock	3,940 00
Premiums received	990 00	Interest paid	236 57
Fines received	16 35	Dues repaid — installment stock	13,197 00
Fees received	5 50	Profits repaid — installment stock	3,812 59
Loans repaid	3,400 00	Salaries	1,607 50
All other receipts	152 92	Taxes	1,366 88
		Other expenses	204 33
		Balance on hand and in bank	3,313 04
Total receipts	$27,919 22	Total disbursements	$27,919 22

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	572	492	$108 00	$153 66	$150 50
2	134	102	96 00	132 12	Dues and 6%.
3	98	93	84 00	111 69	
4	60	60	72 00	92 38	
5	193	163	60 00	74 19	
6	137	122	48 00	57 12	
7	89	89	36 00	41 16	
8	52	42	24 00	26 32	
9	------	55	12 00	12 60	

No. 82—SAN FRANCISCO.

EUREKA LOAN ASSOCIATION.

(Incorporated May 16, 1889.)

D. Hirschfeld, Secretary. Wm. Nicol, President.

Fiscal year ends June 1, 1898.

No. of series, 8. No. of shares, 811.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$42,910 00	Installment stock—dues	$53,064 00
Arrearages		331 80	Earnings apportioned	8,881 18
On shares	$265 00		Advance payments	10 00
On interest	46 80		Reserve and undivided profits	5,003 17
On premiums	20 00		Unearned premiums	1,687 55
Cash on hand and in bank		9,638 87	Other liabilities	655 00
Real estate owned		16,374 03		
Other assets		46 20		
Total assets		$69,300 90	Total liabilities	$69,300 90

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,241 53	Loans on mortgages and stock	$9,230 00
Installment stock—dues	11,320 00	Dues repaid — installment stock	17,383 00
Interest received	3,476 71	Profits repaid — installment stock	556 15
Premiums received	1,172 80	Salaries	720 00
Fines received	4 50	Taxes	885 26
Loans repaid	18,850 00	Other expenses	402 15
All other receipts	1,653 96	All other disbursements	904 07
		Balance on hand and in bank	9,638 87
Total receipts	$39,719 50	Total disbursements	$39,719 50

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	280	200	$108 00	$132 40	$108 00
3	172	124	84 00	98 79	84 00
4	45	39	72 00	82 89	72 00
5	71	41	60 00	67 58	60 00
6	273	233	48 00	52 56	48 00
7	120	85	36 00	38 76	36 00
8	69	39	24 00	25 25	24 00
9	----------	50	12 00	12 32	12 00

No. 83—SAN FRANCISCO.

EUREKA BUILDING AND LOAN ASSOCIATION.

(Incorporated November 3, 1890.)

SOL. J. LEVY, Secretary. A. ANDREWS, President.

Fiscal year ends October 31, 1898.

No. of series, 14. No. of shares, 892½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$55,125 00	Installment stock—dues	$45,739 00
Arrearages		532 80	Earnings apportioned	15,466 32
On shares	$280 00		Advance payments	5 00
On interest	176 99		Reserve and undivided profits	35 25
On premiums	75 81			
Cash on hand and in bank		2,526 57		
Real estate owned		3,050 00		
Other assets		11 20		
Total assets		$61,245 57	Total liabilities	$61,245 57

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$7,481 79	Loans on mortgages and stock	$10,300 00
Installment stock—dues	11,618 50	Interest paid	46
Interest received	3,964 78	Dues repaid — installment stock	16,517 00
Premiums received	1,673 97	Profits repaid — installment stock	5,276 43
Fines received	31 87	Salaries	960 00
Fees received	13 10	Taxes	667 81
Loans repaid	14,700 00	Other expenses	51 30
All other receipts	228 24	All other disbursements	3,412 68
		Balance on hand and in bank	2,526 57
Total receipts	$39,712 25	Total disbursements	$39,712 25

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	155	40	$96 00	$140 74	$134 02
2	240	220	91 00	131 78	123 62
3	35	15	81 00	113 80	103 96
4	55	55	72 00	96 70	85 58
5	79	41	66 00	86 09	77 04
6	40	40	60 00	75 58	68 56
7	47	47	54 00	66 27	60 74
9	27	27	42 00	49 10	45 55
10	35	30	36 00	40 97	37 98
11	52	42	30 00	33 36	31 34
12	104	79	24 00	26 04	24 81
13	135½	130½	18 00	19 08	18 47
14		97½	12 00	12 45	12 18
15		28½	6 00	6 11	6 04

No. 84—SAN FRANCISCO.

EXCELSIOR LOAN ASSOCIATION.

(Incorporated December 31, 1889.)

N. SCHLESINGER, Secretary. CHAS. HARRIS, President.

Fiscal year ends December 31, 1898.

No. of series, 10. No. of shares, 1,972.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$196,700 00	Installment stock—dues	$185,616 00
Arrearages		24,273 40	Earnings apportioned	52,082 96
On shares	$12,357 00		Overdrafts and bills payable	14,339 75
On interest	11,916 40		Reserve and undivided profits	30,000 00
Real estate owned		60,580 11		
Other assets		485 20		
Total assets		$282,038 71	Total liabilities	$282,038 71

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$21,586 00	Overdrafts and bills payable	$31,798 89
Interest received	10,540 09	Interest paid	1,429 84
Fees received	7 00	Dues repaid — installment stock	18,494 00
Loans repaid	16,900 00	Profits repaid — installment stock	4,445 15
Overdrafts and bills payable	14,339 75	Salaries	2,062 50
All other receipts	1,791 16	Taxes	2,257 49
		Other expenses	162 53
		All other disbursements	4,513 60
Total receipts	$65,164 00	Total disbursements	$65,164 00

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	1,080	1,015	$120 00	$158 23	$152 50
2	127	127	108 00	139 00	131 25
3	99	47	96 00	120 52	111 93
4	239	239	84 00	102 80	94 34
5	175	97	72 00	85 84	78 23
6	115	105	60 00	69 64	63 37
7	133	133	48 00	54 19	49 55
8	169	134	36 00	39 51	36 53
9	10	10	24 00	25 58	24 16
10	----------	65	12 00	12 41	12 03

No. 85—SAN FRANCISCO.

FAIRMOUNT LOAN ASSOCIATION.

(Incorporated March 2, 1891.)

T. F. CREIGHTON, Secretary. JOHN H. GRADY, President.

Fiscal year ends April 30, 1899.

No. of series, 16. No. of shares, 1,195⅛.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$71,400 00	Installment stock—dues	$58,004 63
Arrearages		4,047 70	Earnings apportioned	19,526 49
On shares	$1,487 25		Advance payments	30 00
On interest	1,692 10		Overdrafts and bills payable	846 92
On premiums	868 35		Reserve and undivided profits	928 89
Real estate owned		3,559 78		
Other assets		329 45		
Total assets		$79,336 93	Total liabilities	$79,336 93

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$15,709 88	Overdrafts and bills payable	$3,187 36
Interest received	5,600 75	Loans on mortgages and stock	6,600 00
Premiums received	2,899 77	Interest paid	249 56
Fines received	136 75	Dues repaid — installment stock	18,526 25
Fees received	21 60	Profits repaid — installment stock	5,687 44
Loans repaid	11,450 00	Salaries	1,248 00
Overdrafts and bills payable	846 92	Taxes	670 95
All other receipts	13,680 83	Other expenses	219 08
		All other disbursements	13,957 86
Total receipts	$50,346 50	Total disbursements	$50,346 50

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	217	132	$96 00	$142 85	$134 40
2	46½	26½	89 00	129 27	122 00
3	93¼	63¼	83 00	118 03	111 70
4	109	99	77 00	107 13	101 70
5	67¼	67¼	71 00	96 62	89 91
6	102⅜	71⅞	65 00	86 48	80 84
7	40	40	59 00	76 70	70 60
8	34½	24½	53 00	67 28	62 36
9	65½	47	47 00	58 22	53 44
10	98	68	41 00	49 53	45 90
11	124½	111¾	35 00	41 23	38 07
12	185¾	143¾	29 00	33 27	31 11
13	113	63	23 00	25 69	24 32
14	89¾	78¾	17 00	18 47	17 72
15	----	56½	11 00	11 62	11 30
16	----	102	5 00	5 14	5 00

No. 86—SAN FRANCISCO.

FIDELITY BUILDING AND LOAN ASSOCIATION.

(Incorporated March 19, 1887.)

WILLIAM E. LUTZ, Secretary. SAMUEL J. HENDY, President.

Fiscal year ends March 31, 1899.

No. of series, 14. No. of shares, 1,812.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$163,161 00	Installment stock—dues	$115,116 00
Arrearages		2,805 22	Earnings apportioned	40,976 25
On shares	$1,586 00		Advance payments	120 00
On interest	1,064 27		Overdrafts and bills payable	18,142 27
On premiums	154 95		Reserve and undivided profits	10,000 00
Real estate owned		21,699 32	Unearned premiums	2,721 33
Other assets		91 05	Other liabilities	680 74
Total assets		$187,756 59	Total liabilities	$187,756 59

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$21,403 00	Overdrafts and bills payable	$19,184 99
Interest received	11,061 77	Loans on mortgages and stock	22,400 00
Premiums received	888 80	Interest paid	1,434 60
Fees received	40 00	Dues repaid — installment stock	19,716 00
Loans repaid	41,100 00	Profits repaid — installment stock	4,252 36
Overdrafts and bills payable	18,142 27	Salaries	2,225 00
All other receipts	302 50	Taxes	1,621 95
		Other expenses	253 97
		All other disbursements	21,849 47
Total receipts	$92,938 34	Total disbursements	$92,938 34

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	169	169	$132 00	$197 93	$197 93
3	190	160	120 00	174 53	171 04
4	156	116	108 00	152 21	149 17
5	251	231	96 00	130 97	128 35
6	120	120	84 00	110 81	108 60
7	158	98	72 00	91 74	89 90
8	91	56	60 00	73 74	72 27
9	85	67	48 00	56 83	48 00
10	89	89	36 00	41 00	36 00
11	78	78	30 00	33 49	30 00
12	178	163	24 00	26 25	24 00
13	73	70	18 00	19 28	18 00
14	----	351	12 00	12 58	12 00
15	----	44	6 00	6 15	6 00

No. 87—SAN FRANCISCO.

FRANKLIN SAVINGS AND BUILDING ASSOCIATION.

(Incorporated November 18, 1875.)

WM. HATJE, Secretary. F. LUDEMANN, President.

Fiscal year ends November 30, 1898.

No. of series, 2. No. of shares, 1,510.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$116,800 00	Installment stock—dues	$109,324 00
Arrearages		1,698 30	Earnings apportioned	14,474 85
On shares	$1,460 00		Reserve and undivided profits	243 00
On interest	202 50			
On fines, etc.	35 80			
Cash on hand and in bank		5,234 55		
Other assets		309 00		
Total assets		$124,041 85	Total liabilities	$124,041 85

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$8,478 80	Loans on mortgages and stock	$45,000 00
Installment stock—dues	38,692 00	Dues repaid — installment stock	6,850 00
Interest received	8,503 50	Profits repaid — installment stock	181 00
Fines received	18 50	Salaries	480 00
Fees received	24 75	Taxes	838 35
Loans repaid	3,000 00	Other expenses	133 65
		Balance on hand and in bank	5,234 55
Total receipts	$58,717 55	Total disbursements	$58,717 55

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
5	952	906	$98 00	$112 75	$105 00
6	661	604	34 00	35 84	35 00

No. 88—SAN FRANCISCO.

GERMANIA BUILDING AND LOAN ASSOCIATION.

(Incorporated June 6, 1889.)

RUDOLPH MOHR, Secretary. H. F. FORTMANN, President.

Fiscal year ends July 8, 1898.

No. of series, 7. No. of shares, 4,051.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$491,750 00	Installment stock—dues	$386,016 00
Arrearages		4,113 12	Earnings apportioned	222,455 53
On shares	$1,473 00		Advance payments	2,280 00
On interest	1,397 60		Reserve and undivided profits	15 45
On premiums	823 02		Other liabilities	682 18
On fines, etc.	419 50			
Cash on hand and in bank		16,533 11		
Real estate owned		98,260 00		
Other assets		792 93		
Total assets		$611,449 16	Total liabilities	$611,449 16

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$32,256 17	Loans on mortgages and stock	$141,916 22
Installment stock—dues	51,543 00	Interest paid	36 60
Interest received	29,593 84	Dues repaid — installment stock	25,614 00
Premiums received	13,438 08	Profits repaid — installment stock	3,417 35
Fines received	1,319 70	Salaries	1,800 00
Fees received	42 70	Taxes	4,100 78
Loans repaid	118,900 00	Other expenses	336 49
All other receipts	16,330 72	All other disbursements	69,669 66
		Balance on hand and in bank	16,533 11
Total receipts	$263,424 21	Total disbursements	$263,424 21

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	3,288	3,263	$108 00	$173 85	$157 38
2	283	162	72 00	95 55	86 13
3	161	111	60 00	75 35	68 44
4	288	128	48 00	57 20	52 61
5	313	114	36 00	40 81	38 40
6	189	147	24 00	25 95	24 98
7		126	12 00	12 44	12 22

No. 89—SAN FRANCISCO.

GOLDEN GATE MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated August 31, 1892.)

J. M. Ellis, Secretary. A. L. Lengfeld, President.

Fiscal year ends August 31, 1898.

No. of series, 6. No. of shares, 656.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$38,100 00	Installment stock—dues	$41,895 00
Arrearages		1,793 00	Overdrafts and bills payable	5,917 78
On shares	$1,161 00		Reserve and undivided profits	6,065 75
On interest	579 00		Unearned premiums	650 94
On premiums	53 00		Other liabilities	2,390 00
Real estate owned		17,026 47		
Total assets		$56,919 47	Total liabilities	$56,919 47

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$154 08	Overdrafts and bills payable	$10,286 41
Installment stock—dues	6,932 00	Interest paid	592 31
Interest received	2,291 10	Dues repaid — installment stock	4,434 00
Premiums received	328 00	Salaries	600 00
Loans repaid	2,800 00	Taxes	435 27
Overdrafts and bills payable	5,917 78	Other expenses	28 65
All other receipts	1,779 30	All other disbursements	3,825 62
Total receipts	$20,202 26	Total disbursements	$20,202 26

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	474½	464½	$72 00	$72 00	$72 00
2	22½	22½	66 00	66 00	66 00
3	25	25	54 00	54 00	54 00
4	80	80	48 00	48 00	48 00
5	36	20	36 00	36 00	36 00
6	44	44	24 00	24 00	24 00

No. 90—SAN FRANCISCO.

GOLDEN RULE MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated May 17, 1892.)

JNO. BRUCKMAN, Secretary. R. W. OSBORN, President.

Fiscal year ends May 31, 1899.

No. of series, 13. No. of shares, 933.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$59,630 00	Installment stock—dues	$53,760 00
Arrearages		506 75	Earnings apportioned	10,619 75
On shares	$241 00		Overdrafts and bills payable	4,500 00
On interest	160 00		Reserve and undivided profits	6,652 38
On premiums	68 50			
On fines, etc.	37 25			
Cash on hand and in bank		129 34		
Real estate owned		15,266 04		
Total assets		$75,532 13	Total liabilities	$75,532 13

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$52 73	Overdrafts and bills payable	$21,000 00
Installment stock—dues	12,383 00	Loans on mortgages and stock	1,050 00
Interest received	4,701 32	Interest paid	1,147 48
Premiums received	1,945 40	Dues repaid — installment stock	12,240 00
Fines received	155 00	Profits repaid — installment stock	1,662 11
Fees received	17 00	Salaries	1,150 00
Loans repaid	13,270 00	Taxes	938 03
Overdrafts and bills payable	5,500 00	Other expenses	55 99
All other receipts	11,265 10	All other disbursements	9,916 60
		Balance on hand and in bank	129 34
Total receipts	$49,289 55	Total disbursements	$49,289 55

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	452	369	$84 00	$103 58	$103 50
2	64	54	78 00	94 88	93 20
3	11	11	72 00	86 38	84 95
4	106	81	66 00	78 08	76 90
5	50	50	60 00	69 98	69 00
7	15	5	48 00	54 39	52 80
8	108	84	42 00	46 89	44 95
9	135	69	36 00	39 59	38 15
10	21	11	30 00	32 49	31 50
11	38	20	24 00	25 59	24 95
12	79	69	18 00	18 89	18 55
13		75	12 00	12 39	12 25
14		35	6 00	6 09	6 00

No. 91—SAN FRANCISCO.

GOLDEN WEST BUILDING AND LOAN ASSOCIATION.

(Incorporated May 23, 1890.)

SOL. J. LEVY, Secretary. G. BREMER, President

Fiscal year ends June 30, 1898.

No. of series, 15. No. of shares, 768½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$48,700 00	Installment stock—dues	$54,234 00
Arrearages		69 30	Paid-up and prepaid stock	10,505 69
On shares	$26 00		Reserve and undivided profits	5,941 83
On interest	30 30		Unearned premiums	1,210 00
On premiums	13 00			
Cash on hand and in bank		11,114 97		
Real estate owned		11,917 25		
Other assets		90 00		
Total assets		$71,891 52	Total liabilities	$71,891 52

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,728 57	Interest paid	$1 99
Installment stock—dues	9,356 00	Dues repaid — installment stock	6,580 00
Interest received	3,377 70	Profits repaid — installment stock	828 25
Premiums received	956 00	Salaries	892 50
Fines received	50	Taxes	627 32
Fees received	50	Other expenses	167 09
Loans repaid	1,000 00	All other disbursements	129 25
All other receipts	2,922 10	Balance on hand and in bank	11,114 97
Total receipts	$20,341 37	Total disbursements	$20,341 37

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	375	325	$96 00	$120 88	$113 41
3	10	10	84 00	99 94	94 36
4	26	26	81 00	94 96	89 37
6	75	75	75 00	85 96	81 57
8	13	13	69 00	77 54	73 69
9	20	20	66 00	73 50	70 12
10	25	25	63 00	69 51	66 58
11	40	40	60 00	65 63	63 09
13	92	67	48 00	51 08	49 69
14	25	25	42 00	44 32	43 16
15	80	55	36 00	37 65	36 82
16	40	35	30 00	31 20	30 60
17	15	15	24 00	24 74	24 37
18	32½	32½	18 00	18 54	18 27
19	----------	5	6 00	6 12	6 06

No. 92—SAN FRANCISCO.

GRANITE MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated August 23, 1893.)

M. L. CULVER, Secretary. M. C. NUNAN, President.

Fiscal year ends August 31, 1898.

No. of series, 10. No. of shares, 749.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$46,100 00	Installment stock—dues	$26,634 00
Arrearages		1,299 50	Earnings apportioned	5,117 66
On shares	$452 00		Overdrafts and bills payable	19,085 83
On interest	567 70		Reserve and undivided profits	6 65
On premiums	279 80		Other liabilities	350 00
Real estate owned		3,231 22		
Other assets		563 42		
Total assets		$51,194 14	Total liabilities	$51,194 14

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$9,529 00	Overdrafts and bills payable	$19,144 53
Interest received	2,822 11	Loans on mortgages and stock	3,750 00
Premiums received	1,395 94	Interest paid	1,174 91
Fines received	18 45	Dues repaid — installment stock	6,690 00
Fees received	16 70	Profits repaid — installment stock	706 87
Overdrafts and bills payable	19,085 83	Salaries	1,062 00
All other receipts	834 80	Taxes	364 29
		Other expenses	160 43
		All other disbursements	649 80
Total receipts	$33,702 83	Total disbursements	$33,702 83

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	248	188	$60 00	$75 04	$69 00
2	59	49	54 00	66 21	61 29
3	14	14	48 00	57 66	53 76
4	90	90	42 00	49 42	46 41
5	70	60	36 00	41 47	39 24
6	67	57	30 00	33 82	32 25
7	76	76	24 00	26 46	25 44
8	68	68	18 00	19 40	18 81
9	106	76	12 00	12 64	12 36
10	----------	71	6 00	6 17	6 09

No. 93—SAN FRANCISCO.

GUARDIAN LOAN ASSOCIATION.

(Incorporated April, 1890.)

SOL. J. LEVY, Secretary. A. J. BARNETT, President.

Fiscal year ends April 30, 1899.

No. of series, 6. No. of shares, 344.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$33,300 00	Installment stock—dues	$31,422 00
Arrearages		1,039 70	Earnings apportioned	9,207 26
On shares	$635 00		Reserve and undivided profits	3,754 46
On interest	384 95		Unearned premiums	1,600 00
On premiums	19 75		Other liabilities	61 35
Cash on hand and in bank		2,449 29		
Real estate owned		9,256 08		
Total assets		$46,045 07	Total liabilities	$46,045 07

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,008 46	Dues repaid — installment stock	$4,965 00
Installment stock—dues	4,060 50	Profits repaid — installment stock	700 00
Interest received	2,404 56	Salaries	600 00
Premiums received	208 50	Taxes	453 34
All other receipts	744 94	Other expenses	112 73
		All other disbursements	146 60
		Balance on hand and in bank	2,449 29
Total receipts	$9,426 96	Total disbursements	$9,426 96

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	261	211	$108 00	$144 25	$128 00
3	31	31	84 00	103 05	93 65
4	45	45	72 00	85 19	78 59
5	14½	14½	60 00	69 40	64 70
6	32½	32½	48 00	54 02	51 00
7	10	10	36 00	39 44	37 42

No. 94—SAN FRANCISCO.

HOME INVESTMENT ASSOCIATION.

(Incorporated March 22, 1890.)

JOHN KENNY, Secretary. J. F. SULLIVAN, President.

Fiscal year ends March 31, 1899.

No. of series, 10. No. of shares, 822.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$83,819 80	Installment stock—dues	$72,210 00
Arrearages		11,531 60	Earnings apportioned	32,701 02
On shares	$5,093 50		Advance payments	625 60
On interest	5,717 50		Reserve and undivided profits	1,164 64
On premiums	720 60		Unearned premiums	735 00
Cash on hand and in bank		1,824 11	Other liabilities	690 00
Real estate owned		10,596 55		
Other assets		354 20		
Total assets		$108,126 26	Total liabilities	$108,126 26

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$71 70	Overdrafts and bills payable	$22,796 72
Installment stock—dues	10,276 60	Loans on mortgages and stock	3,409 80
Interest received	6,435 49	Interest paid	754 94
Premiums received	1,597 05	Dues repaid — installment stock	23,480 00
Fines received	1,028 30	Profits repaid—installment stock	4,789 32
Fees received	4 00	Salaries	1,040 00
Loans repaid	44,193 50	Taxes	1,147 84
All other receipts	1,115 00	Other expenses	527 89
		All other disbursements	4,951 02
		Balance on hand and in bank	1,824 11
Total receipts	$64,721 64	Total disbursements	$64,721 64

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	605	462½	$108 00	$161 60	$137 43
2	85	75	102 00	150 67	119 28
3	80	55	96 00	138 54	110 47
5	15	5	84 00	115 56	93 40
6	58	15	72 00	94 38	85 14
7	63½	35½	60 00	74 98	69 00
8	87½	56	48 00	57 38	53 76
9	60	55	36 00	41 26	39 24
10	52	23	24 00	26 40	25 44
11		40	12 00	12 65	12 36

No. 95—SAN FRANCISCO.

HOME MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated December 27, 1885.)

CHAS. K. CLARK, Secretary. GEO. MEARNS, President.

Fiscal year ends December 31, 1898.

No. of series, 21. No. of shares, 2,328.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$132,585 00	Installment stock—dues	$112,668 00
Arrearages		4,002 82	Earnings apportioned	36,991 25
On shares	$1,457 00		Overdrafts and bills payable	1,369 29
On interest	1,569 47		Reserve and undivided profits	1,858 97
On premiums	696 90		Other liabilities	3,269 00
On fines, etc.	279 45			
Real estate owned		19,246 09		
Other assets		322 60		
Total assets		$156,156 51	Total liabilities	$156,156 51

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,812 71	Loans on mortgages and stock	$32,551 05
Installment stock—dues	30,240 00	Interest paid	106 92
Interest received	9,915 60	Dues repaid — installment stock	33,250 00
Premiums received	3,630 15	Profits repaid — installment stock	13,790 65
Fines received	280 05	Salaries	1,200 00
Fees received	54 45	Taxes	2,130 71
Loans repaid	46,050 00	Other expenses	445 93
Overdrafts and bills payable	1,369 29	All other disbursements	20,527 44
All other receipts	10,650 45		
Total receipts	$104,002 70	Total disbursements	$104,002 70

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
6	25	25	$126 00	$200 00	$200 00
7	142	91	120 00	186 55	185 55
8	19	19	114 00	174 10	173 10
9	115	43	108 00	161 95	160 95
10	47	42	102 00	150 15	148 15
11	123	107	96 00	138 67	136 67
12	53	51	90 00	127 53	124 53
13	142	107	84 00	116 72	113 72
14	58	58	78 00	106 20	102 20
15	122	99	72 00	96 00	92 00
16	46	146	66 00	86 20	81 20
17	115	115	60 00	76 20	71 20
18	83	78	54 00	67 60	61 40
19	142	106	48 00	58 70	53 80
20	232	232	42 00	50 20	46 50
21	162	125	36 00	42 05	39 35
22	208	173	30 00	34 20	32 30
23	422	333	24 00	26 70	25 50
24	139	99	18 00	19 56	18 85
25	----------	214	12 00	12 70	12 40
26	----------	165	6 00	6 20	6 10

No. 96—SAN FRANCISCO.

HOMESEEKERS LOAN ASSOCIATION.

(Incorporated October, 1890.)

WM. LEWIS, Secretary. BENJ. HARRIS, President.

Fiscal year ends September 30, 1898.

No. of series, 4. No. of shares, 1,234.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$15,500 00	Installment stock—dues	$97,224 00
Arrearages		38,738 60	Overdrafts and bills payable	16,152 19
On shares	$37,460 00		Reserve and undivided profits	8,450 09
On interest	1,278 60		Unearned premiums	2,422 81
Cash on hand and in bank		207 25		
Real estate owned		69,703 24		
Other assets		100 00		
Total assets		$124,249 09	Total liabilities	$124,249 09

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$120 62	Overdrafts and bills payable	$4,000 00
Installment stock—dues	1,912 00	Interest paid	1,186 69
Interest received	1,753 90	Dues repaid — installment stock	7,464 00
Fees received	2 00	Salaries	650 00
Loans repaid	73,700 00	Taxes	738 02
All other receipts	13,290 70	Other expenses	1,771 15
		All other disbursements	74,762 11
		Balance on hand and in bank	207 25
Total receipts	$90,779 22	Total disbursements	$90,779 22

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.
1	853	764½	$96 00	$96 00
2	90	90	84 00	84 00
3	244	191	72 00	72 00
4	47	42	60 00	60 00

No. 97—SAN FRANCISCO.

HOUSEHOLDERS BUILDING AND LOAN ASSOCIATION.

(Incorporated October 5, 1889.)

T. M. GARDINER, Secretary pro tem. ROBERT HUSBAND, President.

Fiscal year ends October 31, 1898.

No. of series, 21. No. of shares, 470.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$37,975 00	Installment stock—dues	$29,646 00
Arrearages		1,436 91	Earnings apportioned	12,559 15
On shares	$735 00		Advance payments	26 00
On interest	519 43		Overdrafts and bills payable	2,754 77
On premiums	182 48		Reserve and undivided profits	1,270 60
Real estate owned		7,683 35	Unearned premiums	858 74
Other assets		20 00		
Total assets		$47,115 26	Total liabilities	$47,115 26

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$281 41	Overdrafts and bills payable	$8,000 00
Installment stock—dues	5,372 00	Loans on mortgages and stock	5,202 61
Interest received	2,661 12	Interest paid	309 52
Premiums received	348 74	Dues repaid — installment stock	8,260 00
Fines received	1 10	Profits repaid — installment stock	2,534 68
Fees received	8 10	Salaries	540 00
Loans repaid	13,552 61	Taxes	402 96
Overdrafts and bills payable	2,754 77	Other expenses	109 58
All other receipts	606 00	All other disbursements	226 50
Total receipts	$25,585 85	Total disbursements	$25,585 85

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	133	133	$108 00	$161 46	
2	45	20	105 00	155 54	
3	56	16	102 00	149 70	
4	26	26	99 00	143 95	
5	30	30	96 00	138 28	
6	6	1	93 00	132 71	
7	6	6	90 00	127 19	
13	9	5	72 00	95 87	Six per cent, and special bonus on older series as Directors determine.
14	10	10	69 00	90 93	
17	22	20	54 00	67 49	
21	20	15	39 00	46 08	
23	30	10	33 00	38 10	
24	20	15	27 00	20 43	
25	16	11	24 00	26 73	
26	21	16	21 00	23 10	
27	46	41	18 00	19 56	
28	8	6	15 00	16 09	
29		15	12 00	12 71	
30		10	9 00	9 41	
31		41	6 00	6 19	
32		23	3 00	3 05	

No. 98—SAN FRANCISCO.

HUMBOLDT BUILDING AND LOAN ASSOCIATION.

(Incorporated September 26, 1890.)

RUDOLPH MOHR, Secretary. HERMAN JOOST, President.

Fiscal year ends October 6, 1898.

No. of series, 7. No. of shares, 2,501.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$186,600 00	Installment stock—dues	$172,896 00
Arrearages		4,580 17	Earnings apportioned	71,654 42
On shares	$1,662 00		Advance payments	73 10
On interest	1,652 00		Reserve and undivided profits	8 70
On premiums	853 80		Other liabilities	526 12
On fines, etc.	412 37			
Cash on hand and in bank		45,108 48		
Real estate owned		8,710 77		
Other assets		158 92		
Total assets		$245,158 34	Total liabilities	$245.158 34

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$44,407 59	Loans on mortgages and stock	$39,624 13
Installment stock—dues	30,409 00	Dues repaid—installm't stock	20,124 00
Interest received	10,303 65	Profits repaid—installm't st'k	6,471 65
Premiums received	5,824 53	Salaries	1,200 00
Fines received	152 54	Taxes	1,957 88
Fees received	39 25	Other expenses	246 98
Loans repaid	22,700 00	All other disbursements	177 02
All other receipts	1,073 58	Balance on hand and in bank	45,108 48
Total receipts	$114,910 14	Total disbursements	$114,910 14

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	1,470	1,321	$96 00	$142 81	$128 76
2	434	332	72 00	94 12	85 27
3	20	20	60 00	74 17	67 79
4	55	45	48 00	56 42	52 21
5	352	346	36 00	40 32	38 16
6	93	93	24 00	25 75	24 87
7	----	344	12 00	12 45	12 22

No. 99—SAN FRANCISCO.

INTER NOS BUILDING AND LOAN ASSOCIATION.

(Incorporated May 22, 1889.)

M. L. CULVER, Secretary. M. C. NUNAN, President.

Fiscal year ends May 31, 1899.

No. of series, 20. No. of shares, 1,854.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$158,200 00	Installment stock—dues	$109,632 00
Arrearages		7,996 30	Earnings apportioned	47,771 58
On shares	$2,948 00		Overdrafts and bills payable	16,074 04
On interest	3,331 05		Reserve and undivided profits	2,076 69
On premiums	1,717 25		Unearned premiums	480 87
Real estate owned		17,992 12	Other liabilities	10,011 62
Other assets		1,858 38		
Total assets		$186,046 80	Total liabilities	$186,046 80

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$23,910 00	Overdrafts and bills payable	$22,822 47
Interest received	11,163 70	Loans on mortgages and stock	21,352 50
Premiums received	4,780 95	Interest paid	1,841 73
Fines received	68 40	Dues repaid — installment stock	16,790 00
Fees received	23 20	Profits repaid — installment stock	4,736 34
Loans repaid	27,050 00	Salaries	1,872 00
Overdrafts and bills payable	16,074 04	Taxes	1,685 32
All other receipts	1,896 15	Other expenses	610 02
		All other disbursements	13,256 06
Total receipts	$84,966 44	Total disbursements	$84,966 44

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	217	207	$120 00	$193 40	$193 40
2	127	108	113 00	177 79	177 79
3	76	46	108 00	167 51	167 51
4	79	79	102 00	155 11	128 01
5	59	59	96 00	143 07	119 04
6	90	86	90 00	131 40	110 25
7	84	81	84 00	120 09	101 64
8	84	79	78 00	109 15	93 21
9	35	19	72 00	98 57	84 96
10	22	22	66 00	88 35	76 89
11	110	72	60 00	79 50	69 00
12	71	63	54 00	69 01	61 29
13	84	59	48 00	59 89	53 76
14	108	83	42 00	51 12	46 41
15	87	72	36 00	42 73	39 24
16	172	127	30 00	34 70	32 25
17	312	236	24 00	27 03	25 41
18	238	128	18 00	19 72	18 81
19	----------	99	12 00	12 78	12 36
20	----------	129	6 00	6 21	6 09

No. 100—SAN FRANCISCO.

ITALIAN-SWISS MUTUAL LOAN ASSOCIATION.

(Incorporated April 1, 1887.)

A. SBARBORO, Secretary. P. BARBIERI, President.

Fiscal year ends March 31, 1899.

No. of series, 12. No. of shares, 2,720½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$208,350 00	Installment stock—dues	$182,892 00
Arrearages		2,027 65	Earnings apportioned	53,642 94
On shares	$819 50		Advance payments	493 75
On interest	729 50		Reserve and undivided profits	4,281 70
On premiums	23 75		Other liabilities	597 33
On fines, etc.	454 90			
Cash on hand and in bank		6,118 78		
Real estate owned		24,077 83		
Other assets		1,333 46		
Total assets		$241,907 72	Total liabilities	$241,907 72

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$29,030 99	Loans on mortgages and stock	$317 00
Installment stock—dues	34,002 00	Interest paid	1,304 23
Interest received	13,751 55	Dues repaid — installment stock	97,066 50
Premiums received	1,544 36	Profits repaid — installment stock	42,602 31
Fines received	159 25	Salaries	2,400 00
Fees received	50 00	Taxes	2,951 50
Loans repaid	77,535 00	Other expenses	647 68
All other receipts	5,991 62	All other disbursements	8,656 77
		Balance on hand and in bank	6,118 78
Total receipts	$162,064 77	Total disbursements	$162,064 77

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	630	67½	$132 00	$200 00	$200 00
2	208½	188½	132 00	194 13	178 59
3	187½	156	120 00	170 32	157 74
4	184½	157	108 00	147 31	137 48
5	355½	340½	96 00	125 96	118 47
6	268	215½	84 00	106 17	100 62
7	325	275	72 00	85 87	80 32
8	181½	144	60 00	69 23	65 53
9	319	292½	48 00	53 63	50 81
10	344	316½	36 00	39 30	37 65
11	238½	162½	24 00	25 62	24 81
12	----------	405	12 00	12 60	13 30

No. 101—SAN FRANCISCO.

MECHANICS BUILDING AND LOAN ASSOCIATION.

(Incorporated January 6, 1891.)

WILLIAM E. LUTZ, Secretary. FREDERICK FILLMORE, President.

Fiscal year ends December 31, 1898.

No. of series, 11. No. of shares, 1,037.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$67,540 00	Installment stock—dues	$63,936 00
Arrearages		706 60	Earnings apportioned	14,875 79
On shares	$384 00		Reserve and undivided profits	1,200 00
On interest	274 60		Other liabilities	341 85
On premiums	48 00			
Cash on hand and in bank		3,384 63		
Real estate owned		8,685 31		
Other assets		37 10		
Total assets		$80,353 64	Total liabilities	$80,353 64

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$11,987 00	Overdrafts and bills payable	$768 12
Interest received	4,503 95	Loans on mortgages and stock	5,427 50
Premiums received	97 25	Interest paid	150 20
Fees received	15 90	Dues repaid — installment stock	10,146 00
Loans repaid	5,950 00	Profits repaid — installment stock	1,509 12
All other receipts	987 15	Salaries	925 00
		Taxes	783 96
		Other expenses	88 72
		All other disbursements	358 00
		Balance on hand and in bank	3,384 63
Total receipts	$23,541 25	Total disbursements	$23,541 25

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	240	195	$96 00	$124 15	
2	245	235	84 00	105 59	
3	117	100	72 00	87 89	
4	192	182	60 00	71 06	
5	136	37	48 00	55 11	
6	59	54	36 00	40 02	Dues and 6% interest.
7	44	39	30 00	32 81	
8	24	24	24 00	25 81	
9	15	12	18 00	19 03	
10	------------	120	12 00	12 47	
11	------------	39	6 00	6 12	

No. 102—SAN FRANCISCO.

MERCHANTS LOAN ASSOCIATION.

(Incorporated June 21, 1889.)

JAMES B. BROOKS, Secretary. P. N. ARONSON, President.

Fiscal year ends June 30, 1898.

No. of series, 8. No. of shares, 658½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$58,800 00	Installment stock—dues	$66,426 00
Arrearages		1,432 10	Earnings apportioned	15,116 06
On shares	$836 00		Advance payments	125 00
On interest	544 60		Reserve and undivided profits	10,285 33
On rents	51 50		Unearned premiums	2,669 72
Cash on hand and in bank		4,938 44	Other liabilities	1,451 47
Real estate owned		30,204 39		
Other assets		698 65		
Total assets		$96,073 58	Total liabilities	$96,073 58

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$6,502 56	Loans on mortgages and stock	$4,900 00
Installment stock—dues	8,124 00	Dues repaid — installment stock	11,413 00
Interest received	3,329 15	Profits repaid — installment stock	605 85
Loans repaid	14,300 00	Salaries	600 00
All other receipts	2,153 49	Taxes	748 66
		Other expenses	372 75
		All other disbursements	10,830 50
		Balance on hand and in bank	4,938 44
Total receipts	$34,409 20	Total disbursements	$34,409 20

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	605½	510½	$108 00	$133 48	$108 00
2	67	46	96 00	116 54	96 00
3	59	56	84 00	100 02	84 00
4	6	6	72 00	83 92	72 00
5	5	5	60 00	68 84	60 00
6	18	18	48 00	53 64	48 00
7	14	14	36 00	39 21	36 00
8	3	3	24 00	25 46	24 00

No. 103—SAN FRANCISCO.

MISSION HOME AND LOAN ASSOCIATION.

(Incorporated March, 1889.)

T. F. CREIGHTON, Secretary. JOHN H. GRADY, President.

Fiscal year ends March 31, 1899.

No. of series, 17. No. of shares, 1,748½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$128,150 00	Installment stock—dues	$99,403 50
Arrearages		10,904 85	Earnings apportioned	41,876 88
On shares	$4,037 00		Advance payments	10 00
On interest	4,583 72		Overdrafts and bills payable	2,664 08
On premiums	2,284 13		Reserve and undivided profits	3,178 43
Real estate owned		8,407 33	Unearned premiums	97 20
Other assets		1,489 10	Other liabilities	1,721 19
Total assets		$148,951 28	Total liabilities	$148,951 28

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$21,427 25	Overdrafts and bills payable	$11,107 05
Interest received	8,463 90	Loans on mortgages and stock	7,200 00
Premiums received	3,921 30	Interest paid	594 93
Fines received	397 55	Dues repaid — installment stock	23,402 00
Fees received	31 10	Profits repaid — installment stock	8,782 66
Loans repaid	17,950 00	Salaries	1,702 50
Overdrafts and bills payable	2,664 08	Taxes	1,403 70
All other receipts	11,752 15	Other expenses	478 38
		All other disbursements	11,936 11
Total receipts	$66,607 33	Total disbursements	$66,607 33

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	249¼	185¼	$120 00	$193 20	$180 00
2	137	112	111 00	173 63	162 34
3	127	84½	105 00	161 04	150 94
4	86	71	96 00	142 85	134 40
5	116	101	84 00	119 87	113 40
6	20¼	16½	78 00	108 93	103 35
7	128	128	72 00	98 35	91 44
8	112½	77½	60 00	78 30	72 00
9	68¼	52¼	54 00	68 82	63 72
10	87	59½	48 00	59 71	54 72
11	82	47	42 00	50 97	47 14
12	180½	170½	36 00	42 59	39 24
13	162	137	30 00	34 58	32 25
14	155¾	124¼	24 00	26 93	25 44
15	119½	94½	18 00	19 64	18 81
16		184½	12 00	12 73	12 36
17		103¼	6 00	6 18	6 09

No. 104—SAN FRANCISCO.

MONARCH MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated May 19, 1891.)

RUDOLPH MOHR, Secretary. D. BECKER, President.

Fiscal year ends May 9, 1899.

No. of series, 8. No. of shares, 996.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$63,831 68	Installment stock—dues	$54,540 00
Arrearages		4,003 36	Earnings apportioned	17,210 44
On shares	$1,620 00		Overdrafts and bills payable	5,000 00
On interest	1,347 00		Reserve and undivided profits	6 75
On premiums	698 00			
On fines, etc.	338 36			
Cash on hand and in bank		1,029 79		
Real estate owned		7,723 49		
Other assets		168 87		
Total assets		$76,757 19	Total liabilities	$76,757 19

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$246 70	Overdrafts and bills payable	$8,000 00
Installment stock—dues	11,692 00	Loans on mortgages and stock	14,500 00
Interest received	3,115 75	Interest paid	756 74
Premiums received	1,817 90	Dues repaid — installment stock	4,377 00
Fines received	99 84	Profits repaid — installment stock	833 63
Fees received	6 20	Salaries	720 00
Loans repaid	19,400 00	Taxes	809 42
All other receipts	2,025 20	Other expenses	133 58
		All other disbursements	7,243 43
		Balance on hand and in bank	1,029 79
Total receipts	$38,403 59	Total disbursements	$38,403 59

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	281	263	$96 00	$142 13	$128 29
2	16	16	84 00	116 98	105 43
3	63	58	72 00	94 65	85 39
4	47	38	60 00	74 64	68 05
5	108	94	48 00	56 58	52 29
6	415	385	36 00	40 31	38 15
7	151	118	24 00	25 74	24 87
8		24	12 00	12 39	12 19

No. 105—SAN FRANCISCO.

MUTUAL SAVINGS FUND, LOAN, AND BUILDING ASSOCIATION.

(Incorporated June 4, 1883.)

JOHN W. BUTLER, Secretary. FRED W. ZEILE, President.

Fiscal year ends June 30, 1898.

No. of series, 20. No. of shares, 2,119.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$174,023 00	Installment stock—dues	$116,592 00
Arrearages		1,320 95	Earnings apportioned	48,929 36
On shares	$719 00		Advance payments	1,810 00
On interest	530 95		Overdrafts and bills payable	3,635 00
On premiums	71 00		Reserve and undivided profits	5,517 62
Cash on hand and in bank		6,623 51	Unearned premiums	5,455 56
Real estate owned		1,156 80	Other liabilities	1,208 60
Other assets		23 88		
Total assets		$183,148 14	Total liabilities	$183,148 14

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$5,018 08	Overdrafts and bills payable	$23,437 40
Installment stock—dues	28,377 00	Loans on mortgages and stock	32,815 85
Interest received	16,367 41	Interest paid	896 25
Premiums received	1,878 83	Dues repaid — installment stock	56,257 00
Fines received	69 23	Profits repaid — installment stock	33,600 27
Fees received	42 20	Salaries	1,429 75
Loans repaid	80,064 45	Taxes	1,780 11
Overdrafts and bills payable	24,072 40	Other expenses	568 01
All other receipts	1,641 10	All other disbursements	122 55
		Balance on hand and in bank	6,623 51
Total receipts	$157,530 70	Total disbursements	$157,530 70

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
11	182	49	$120 00	$194 37	$194 37
12	40	40	114 00	181 09	146 13
13	165	165	108 00	168 18	136 80
14	166	166	102 00	155 65	127 65
15	83	83	96 00	143 50	118 68
16	80	80	90 00	131 71	109 89
17	178	158	84 00	120 31	101 28
18	101	101	78 00	109 28	92 85
19	91	91	72 00	98 62	84 60
20	21	21	66 00	88 34	76 53
21	68	54	60 00	78 43	68 64
22	73	68	54 00	68 90	60 93
23	79	69	48 00	59 75	53 40
24	66	66	42 00	50 96	46 05
25	7	7	36 00	42 56	38 88
26	63	63	30 00	34 53	31 89
27	101	86	24 00	26 87	25 08
28	310	310	18 00	19 59	18 45
29		285	12 00	12 68	12 00
30		157	6 00	6 15	6 00

No. 106—SAN FRANCISCO.

NATIONAL HOME AND LOAN ASSOCIATION.

(Incorporated November 5, 1885.)

N. SCHLESINGER, Secretary. AUGUST DRUCKER, President.

Fiscal year ends January 31, 1899.

No. of series, 7. No. of shares, 1,166.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$96,300 00	Installment stock—dues	$60,228 00
Arrearages		4,165 61	Earnings apportioned	15,603 92
On shares	$1,983 00		Overdrafts and bills payable	32,762 50
On interest	1,582 61		Reserve and undivided profits	1,279 19
On premiums	600 00		Other liabilities	778 13
Real estate owned		9,669 40		
Other assets		516 73		
Total assets		$110,651 74	Total liabilities	$110,651 74

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$14,911 00	Overdrafts and bills payable	$28,293 55
Interest received	14,163 39	Loans on mortgages and stock	25,000 00
Premiums received	12 20	Interest paid	3,932 74
Fees received	22 00	Dues repaid — installment stock	36,330 00
Loans repaid	80,521 86	Profits repaid — installment stock	17,103 65
Overdrafts and bills payable	32,762 50	Salaries	1,555 00
All other receipts	31,176 91	Taxes	1,416 24
		Other expenses	195 01
		All other disbursements	59,743 67
Total receipts	$173,569 86	Total disbursements	$173,569 86

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	415	150	$136 00	$200 45	$200 45
3	25	25	72 00	88 15	83 20
4	212	212	60 00	71 20	66 72
5	313	313	48 00	55 23	51 61
6	150	145	36 00	40 09	37 73
7	101	101	24 00	25 84	24 55
8		220	12 00	12 48	12 10

No. 107—SAN FRANCISCO.

OCCIDENTAL LOAN ASSOCIATION.

(Incorporated August 26, 1885.)

E. GUNZBURGER, Secretary. GEO. W. DIXON, President.

Fiscal year ends September 4, 1898.

No. of series, 12. No. of shares, 1,449.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$181,600 00	Installment stock—dues	$117,809 00
Arrearages		8,422 80	Earnings apportioned	37,893 91
On shares	$5,151 00		Advance payments	5 00
On interest	3,244 90		Overdrafts and bills payable	39,041 65
On premiums	26 90		Reserve and undivided profits	3,788 55
Real estate owned		16,071 76	Unearned premiums	5,856 25
Other assets		336 00	Other liabilities	2,036 20
Total assets		$206,430 56	Total liabilities	$206,430 56

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$17,142 00	Overdrafts and bills payable	$44,837 45
Interest received	12,507 60	Loans on mortgages and stock	19,500 00
Premiums received	351 90	Interest paid	2,649 98
Fines received	484 75	Dues repaid — installment stock	41,256 00
Fees received	10 80	Profits repaid — installment stock	14,082 31
Loans repaid	56,600 00	Salaries	1,995 00
Overdrafts and bills payable	39,041 65	Taxes	1,739 01
All other receipts	2,338 96	Other expenses	344 58
		All other disbursements	2,073 33
Total receipts	$128,477 66	Total disbursements	$128,477 66

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	35	35	$127 00	$200 00	$200 00
2	38				
3	164	116	132 00	198 86	172 12
4	250	158	120 00	172 36	151 42
5	321	194	108 00	147 27	131 56
6	156	156	96 00	124 27	112 96
7	246	186	84 00	103 10	95 46
8	176	176	72 00	84 83	78 42
9	123	89	60 00	68 40	64 20
10	43	43	48 00	53 19	50 60
11	188	148	36 00	38 86	37 43
12	30	30	24 00	25 27	24 64
13		118	12 00	12 33	12 17

No. 108—SAN FRANCISCO.

PACIFIC COAST LOAN ASSOCIATION.

(Incorporated October 3, 1890.)

CHAS. E. NAYLOR, Secretary. MARK SHELDON, President.

Fiscal year ends September 30, 1898.

No. of series, 9. No. of shares, 977.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$77,900 00	Installment stock—dues	$63,066 00
Arrearages		727 20	Earnings apportioned	22,832 30
On shares	$282 00		Advance payments	15 00
On interest	308 90		Overdrafts and bills payable	273 31
On premiums	110 00		Reserve and undivided profits	1,273 17
On fines, etc.	26 30		Unearned premiums	693 90
Cash on hand and in bank		597 70	Other liabilities	1,001 17
Real estate owned		9,929 95		
Total assets		$89,154 85	Total liabilities	$89,154 85

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$4,476 21	Loans on mortgages and stock	$23,000 00
Installment stock—dues	11,780 00	Interest paid	125 64
Interest received	5,956 80	Dues repaid — installment stock	5,597 00
Premiums received	1,721 60	Profits repaid — installment stock	1,342 48
Fines received	102 50	Salaries	770 00
Fees received	21 90	Taxes	999 40
Loans repaid	9,400 00	Other expenses	330 15
Overdrafts and bills payable	273 31	All other disbursements	4,400 90
All other receipts	3,430 95	Balance on hand and in bank	597 70
Total receipts	$37,163 27	Total disbursements	$37,163 27

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	440	390	$96 00	$136 32	$126 24
2	100	100	84 00	114 87	105 60
3	110	110	72 00	94 68	86 74
4	50	38	60 00	75 75	69 45
5	38	38	48 00	58 08	53 04
6	65	53	36 00	41 67	38 84
7	66	66	24 00	26 52	25 44
8		103	12 00	12 63	12 36
9		79	6 00	6 15	6 00

No. 109—SAN FRANCISCO.

PACIFIC LOAN ASSOCIATION.

(Incorporated December 8, 1884.)

E. GUNZBURGER, Secretary. D. J. MURPHY, President.

Fiscal year ends December 6, 1898.

No. of series, 10. No. of shares, 1,921.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$167,600 00	Installment stock—dues	$166,800 00
Arrearages	6,452 90	Earnings apportioned	45,616 16
On shares $3,744 00		Advance payments	121 00
On interest 2,708 90		Overdrafts and bills payable	21,233 67
Cash on hand and in bank	5,180 01	Reserve and undivided profits	8,997 17
Real estate owned	65,461 83	Unearned premiums	3,185 05
Other assets	1,735 48	Other liabilities	477 17
Total assets	$246,430 22	Total liabilities	$246,430 22

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$25,431 00	Overdrafts and bills payable	$12,400 43
Interest received	13,324 75	Loans on mortgages and stock	8,600 00
Premiums received	206 50	Interest paid	1,404 21
Fines received	111 40	Dues repaid—installment stock	62,685 00
Fees received	2 80	Profits repaid—installment stock	21,671 65
Loans repaid	97,300 00	Salaries	1,715 00
All other receipts	10,281 94	Taxes	2,434 59
		Other expenses	307 93
		All other disbursements	30,259 57
		Balance on hand and in bank	5,180 01
Total receipts	$146,658 39	Total disbursements	$146,658 39

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	170	150	$132 00	$191 48	$176 61
5	412	257	120 00	166 99	148 20
6	241	216	108 00	142 70	128 82
7	319	319	96 00	120 89	110 93
8	309	284	84 00	99 93	93 55
9	418	333	72 00	82 52	77 26
10	80	30	60 00	66 71	63 35
11	155	140	48 00	52 25	50 13
12	213	148	36 00	38 31	37 15
13	----------	44	12 00	12 39	12 20

No. 110—SAN FRANCISCO.

PACIFIC MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated August 21, 1891.)

JOHN R. HILLMAN, Secretary. ROLLA V. WATT, President.

Fiscal year ends August 31, 1898.

No. of series, 14. No. of shares, 1,108.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$59,200 00	Installment stock—dues	$50,106 00
Arrearages		1,065 61	Earnings apportioned	11,104 45
On shares	$754 00		Advance payments	394 00
On interest	311 61		Overdrafts and bills payable	6,157 07
Cash on hand and in bank		59 95	Reserve and undivided profits	343 40
Real estate owned		8,827 01	Unearned premiums	3,514 50
Other assets		2,871 13	Other liabilities	404 28
Total assets		$72,023 70	Total liabilities	$72,023 70

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$143 05	Overdrafts and bills payable	$9,753 72
Installment stock—dues	12,926 00	Interest paid	618 85
Interest received	4,037 62	Dues repaid — installment stock	5,928 00
Fines received	15 75	Profits repaid — installment stock	1,251 77
Fees received	29 50	Salaries	735 00
Overdrafts and bills payable	3,523 92	Taxes	571 78
All other receipts	1,105 62	Other expenses	167 23
		All other disbursements	2,695 16
		Balance on hand and in bank	59 95
Total receipts	$21,781 46	Total disbursements	$21,781 46

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	281	231	$84 00	$109 42	$109 42
2	40	40	78 00	99 48	99 48
3	141	136	72 00	89 63	89 63
4	21	21	66 00	80 49	80 49
5	25	15	60 00	71 71	71 71
6	30	30	54 00	63 22	63 22
7	70	60	48 00	55 07	55 07
8	26	26	42 00	47 24	45 93
9	107	92	36 00	39 65	38 73
10	67	67	30 00	32 41	31 20
11	10	10	24 00	25 48	24 74
12	105	75	18 00	18 83	18 00
13	----------	195	12 00	12 37	12 00
14	----------	110	6 00	6 11	6 00

No. 111—SAN FRANCISCO.

PROVIDENT MUTUAL LOAN ASSOCIATION.

(Incorporated September 24, 1887.)

D. HIRSCHFELD, Secretary. SAMUEL WEIL, President.

Fiscal year ends September 30, 1898.

No. of series, 11. No. of shares, 1,671.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$124,700 00	Installment stock—dues	$103,656 00
Arrearages		2,670 70	Earnings apportioned	32,794 03
On shares	$945 00		Advance payments	45 00
On interest	1,198 95		Reserve and undivided profits	5,804 88
On premiums	526 75		Unearned premiums	2,970 00
Cash on hand and in bank		4,996 34	Other liabilities	1,435 00
Real estate owned		14,218 87		
Other assets		119 00		
Total assets		$146,704 91	Total liabilities	$146,704 91

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,529 91	Loans on mortgages and stock	$11,550 00
Installment stock—dues	20,844 00	Interest paid	284 48
Interest received	9,019 55	Dues repaid — installment stock	25,206 00
Premiums received	3,222 45	Profits repaid — installment stock	10,724 72
Fines received	19 10	Salaries	1,740 00
Fees received	15 20	Taxes	1,557 25
Loans repaid	19,650 00	Other expenses	568 06
All other receipts	736 99	All other disbursements	410 35
		Balance on hand and in bank	4,996 34
Total receipts	$57,037 20	Total disbursements	$57,037 20

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	226	81	$132 00	$200 28	$200 28
2	81	81	120 00	176 47	174 00
3	93	53	108 00	153 79	149 00
4	162	162	96 00	132 22	127 00
5	126	105	84 00	111 77	107 00
6	291	291	72 00	92 44	87 00
7	147	147	60 00	74 23	69 00
8	239	224	48 00	57 14	53 75
9	148	148	36 00	41 18	39 25
10	282	229	24 00	26 33	25 40
11		150	12 00	12 61	12 30

No. 112—SAN FRANCISCO.

PRUDENCE BUILDING AND LOAN ASSOCIATION.

(Incorporated March 9, 1891.)

J. M. Ellis, Secretary. A. H. Lissak, President.

Fiscal year ends March 31, 1899.

No. of series, 9. No. of shares, 1,229½.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$86,850 00	Installment stock—dues	$80,526 00
Arrearages		1,242 05	Earnings apportioned	26,222 53
On shares	$705 00		Reserve and undivided profits	4,096 03
On interest	526 55			
On premiums	10 50			
Cash on hand and in bank		5,210 52		
Real estate owned		17,472 49		
Other assets		69 50		
Total assets		$110,844 56	Total liabilities	$110,844 56

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,010 79	Loans on mortgages and stock	$11,800 00
Installment stock—dues	14,702 00	Interest paid	138 75
Interest received	5,687 40	Dues repaid — installment stock	12,804 00
Premiums received	2,134 50	Profits repaid — installment stock	2,198 86
Fines received	12 30	Salaries	1,356 30
Fees received	12 60	Taxes	802 36
Loans repaid	9,200 00	Other expenses	107 28
All other receipts	2,682 12	All other disbursements	3,023 64
		Balance on hand and in bank	5,210 52
Total receipts	$37,441 71	Total disbursements	$37,441 71

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	644	562	$96 00	$132 94	Dues and 6%.
2	66	42	90 00	122 19	
3	65	65	84 00	111 50	
4	31	15	72 00	91 50	
5	52	47	60 00	72 30	
6	115	100	48 00	55 37	
7	82½	67½	36 00	39 89	
8	201	196	24 00	25 85	
9	------------	125	12 00	12 72	

No. 113—SAN FRANCISCO.

SAFETY MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated May 12, 1894.)

C. A. Buckbee, Secretary. E. W. Newhall, President.

Fiscal year ends April 30, 1899.

No. of series, 10. No. of shares, 1,697½.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$63,701 33	Installment stock—dues	$67,479 00
Arrearages		3,556 96	Earnings apportioned	12,102 13
On shares	$1,162 50		Advance payments	390 70
On interest	1,729 71		Reserve and undivided profits	363 58
On premiums	664 75		Other liabilities	83
Cash on hand and in bank		6,823 95		
Real estate owned		6,254 00		
Total assets		$80,336 24	Total liabilities	$80,336 24

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,362 85	Loans on mortgages and stock	$23,724 25
Installment stock—dues	21,398 00	Interest paid	27 91
Interest received	4,184 52	Dues repaid — installment stock	10,714 50
Premiums received	1,643 45	Profits repaid — installment stock	976 77
Fines received	339 06	Salaries	1,240 00
Fees received	20 60	Taxes	764 74
Loans repaid	21,820 00	Other expenses	170 50
All other receipts	130 11	All other disbursements	6,455 97
		Balance on hand and in bank	6,823 95
Total receipts	$50,898 59	Total disbursements	$50,898 59

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	614	549	$60 00	$73 79	$69 15
2	185	165	54 00	64 74	61 29
3	95	85	48 00	56 15	53 76
4	164	124½	42 00	48 06	46 41
5	208½	130½	36 00	40 26	39 24
6	152	97	30 00	32 83	32 25
7	235	200	24 00	25 73	25 44
8	102	87	18 00	18 94	18 81
9		131½	12 00	12 40	12 36
10		128	6 00	6 01	6 00

No. 114—SAN FRANCISCO.

SAN FRANCISCO MUTUAL LOAN ASSOCIATION.

(Incorporated October 28, 1882.)

A. SBARBORO, Secretary. THOMAS J. WELSH, President.

Fiscal year ends October 31, 1898.

No. of series, 13. No. of shares, 1,734.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$182,316 98	Installment stock—dues	$150,373 50
Arrearages		2,541 40	Earnings apportioned	42,832 43
On shares	$1,279 50		Advance payments	1,623 00
On interest	730 25		Reserve and undivided profits	3,276 76
On premiums	28 50		Other liabilities	7,203 79
On fines, etc.	503 15			
Cash on hand and in bank		1,697 91		
Real estate owned		17,999 25		
Other assets		753 94		
Total assets		$205,309 48	Total liabilities	$205,309 48

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$542 36	Loans on mortgages and stock	$6,500 00
Installment stock—dues	24,071 00	Interest paid	1,571 63
Interest received	13,544 27	Dues repaid — installment stock	71,285 00
Premiums received	572 65	Profits repaid — installment stock	23,572 03
Fines received	323 75	Salaries	3,600 00
Fees received	23 30	Taxes	2,514 37
Loans repaid	80,838 35	Other expenses	541 15
All other receipts	5,806 52	All other disbursements	14,440 11
		Balance on hand and in bank	1,697 91
Total receipts	$125,722 20	Total disbursements	$125,722 20

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	206½	40	$135 00	$200 00	$200 00
5	344	243½	141 00	200 00	200 00
6	192	150½	132 00	180 89	168 66
7	206½	148	120 00	158 76	149 07
8	278	174½	108 00	137 43	130 07
9	201	137	96 00	117 04	111 78
10	174	140	84 00	98 07	94 55
11	239½	209	72 00	81 23	77 53
12	68½	65	60 00	66 17	63 70
13	53½	48½	48 00	51 38	49 69
14	122½	93	36 00	37 40	36 70
15	164	101	24 00	24 85	24 42
16	------------	184	12 00	12 40	12 20

No. 115—SAN FRANCISCO.

SAN FRANCISCO AND OAKLAND MUTUAL LOAN ASSOCIATION.

(Incorporated January 3, 1889.)

A. SBARBORO, Secretary. THOMAS J. WELSH, President.

Fiscal year ends December 31, 1898.

No. of series, 10. No. of shares, 2,880.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$199,075 80	Installment stock—dues	$189,792 00
Arrearages		1,582 05	Earnings apportioned	51,864 58
On shares	$718 00		Advance payments	248 00
On interest	704 45		Reserve and undivided profits	1,277 71
On premiums	4 00		Other liabilities	643 79
On fines, etc.	155 60			
Cash on hand and in bank		24,974 46		
Real estate owned		16,579 24		
Other assets		1,614 53		
Total assets		$243,826 08	Total liabilities	$243,826 08

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$20,073 15	Loans on mortgages and stock	$29,960 75
Installment stock—dues	37,401 00	Interest paid	45 10
Interest received	12,406 74	Dues repaid — installment stock	33,063 00
Premiums received	1,639 00	Profits repaid — installment stock	5,719 52
Fines received	187 61	Salaries	2,400 00
Fees received	49 35	Taxes	2,212 93
Loans repaid	34,163 37	Other expenses	576 83
All other receipts	3,205 37	All other disbursements	10,173 00
		Balance on hand and in bank	24,974 46
Total receipts	$109,125 59	Total disbursements	$109,125 59

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	508	473	$120 00	$167 38	$155 53
2	509½	264½	108 00	145 77	136 32
3	245½	207½	96 00	124 37	117 27
4	293	251	84 00	105 42	100 06
5	315	258	72 00	86 36	80 61
6	126	116	60 00	69 52	65 71
7	412½	327	48 00	53 57	50 78
8	375	271	36 00	39 15	37 57
9	458½	327½	24 00	25 60	24 80
10		384½	12 00	12 50	12 25

No. 116—SAN FRANCISCO.

SAN FRANCISCO HOME MUTUAL LOAN ASSOCIATION.

(Incorporated November 8, 1890.)

A. SBARBORO, Secretary. THOS. J. WELSH, President.

Fiscal year ends October 31, 1898.

No. of series, 8. No. of shares, 1,251.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$79,595 34	Installment stock—dues	$78,102 00
Arrearages		256 95	Earnings apportioned	16,319 60
On shares	$92 50		Advance payments	110 00
On interest	97 50		Reserve and undivided profits	1,068 53
On premiums	7 00		Other liabilities	220 02
On fines, etc.	59 95			
Cash on hand and in bank		10,191 94		
Real estate owned		5,598 89		
Other assets		177 03		
Total assets		$95,820 15	Total liabilities	$95,820 15

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$7,367 89	Loans on mortgages and stock	$9,700 00
Installment stock—dues	16,593 00	Interest paid	92 85
Interest received	5,030 57	Dues repaid — installment stock	18,206 50
Premiums received	400 05	Profits repaid — installment stock	2,859 67
Fines received	74 00	Salaries	900 00
Fees received	12 35	Taxes	1,065 83
Loans repaid	13,600 00	Other expenses	484 33
All other receipts	697 93	All other disbursements	274 67
		Balance on hand and in bank	10,191 94
Total receipts	$43,775 79	Total disbursements	$43,775 79

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	384	286	$96 00	$123 68	$116 76
2	241½	212	84 00	104 20	99 15
3	168	113½	72 00	85 90	80 34
4	153	118	60 00	68 91	65 34
5	173	173	48 00	53 19	50 59
6	215½	175	36 00	38 57	37 28
7	85	75	24 00	25 33	24 66
8	----------	98½	12 00	12 45	12 22

No. 117—SAN FRANCISCO.

SECURITY LOAN ASSOCIATION.

(Incorporated April 17, 1888.)

H. L. REA, Secretary. LOUIS METZGER, President.

Fiscal year ends April 30, 1899.

No. of series, 5. No. of shares, 437.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$39,591 44	Installment stock—dues	$49,716 00
Arrearages		5,821 21	Overdrafts and bills payable	1,064 49
On shares	$5,526 00		Reserve and undivided profits	13,542 93
On interest	295 21		Unearned premiums	2,995 22
Real estate owned		16,350 00		
Other assets		5,555 99		
Total assets		$67,318 64	Total liabilities	$67,318 64

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$94 45	Dues repaid — installment stock	$19,592 00
Installment stock—dues	4,458 00	Salaries	840 00
Interest received	2,250 24	Taxes	665 50
Loans repaid	7,000 00	Other expenses	55 18
Overdrafts and bills payable	1,064 49	All other disbursements	7,190 94
All other receipts	13,476 44		
Total receipts	$28,343 62	Total disbursements	$28,343 62

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	465	316	$132 00	$132 00	$132 00
5	28	6	84 00	84 00	84 00
6	100	100	72 00	72 00	72 00
10	10	10	24 00	24 00	24 00
11	------------	5	12 00	12 00	12 00

No. 118—SAN FRANCISCO.

TRIUMPH LOAN ASSOCIATION.

(Incorporated January 30, 1891.)

JOHN BRUCKMAN, Secretary. A. STEINBERGER, President.

Fiscal year ends January 31, 1899.

No. of series, 16. No. of shares, 1,228.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$69,100 00	Installment stock—dues	$70,008 00
Arrearages		1,993 05	Earnings apportioned	16,700 07
On shares	$649 00		Reserve and undivided profits	8,012 98
On interest	751 90		Unearned premiums	2,226 00
On premiums	380 05			
On fines, etc.	212 10			
Cash on hand and in bank		3,552 62		
Real estate owned		22,301 38		
Total assets		$96,947 05	Total liabilities	$96,947 05

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$16,956 00	Overdrafts and bills payable	$18,281 52
Interest received	5,955 44	Loans on mortgages and stock	900 00
Premiums received	2,543 90	Dues repaid — installment stock	40,318 00
Fines received	278 15	Profits repaid — installment stock	5,961 50
Fees received	19 90	Salaries	1,557 50
Loans repaid	52,250 00	Taxes	789 70
All other receipts	528 08	Other expenses	74 33
		All other disbursements	7,096 30
		Balance on hand and in bank	3,552 62
Total receipts	$78,531 47	Total disbursements	$78,531 47

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	440	230	$96 00	$126 04	$124 80
2	55	45	90 00	116 40	115 30
3	167	137	84 00	107 00	104 84
4	23	23	78 00	97 83	95 75
5	197	122	72 00	88 89	86 05
6	63	50	66 00	80 19	77 80
7	15	15	60 00	71 73	69 00
8	56	45	54 00	63 50	61 30
9	23	13	48 00	55 51	53 75
10	391	110	42 00	47 75	46 40
11	249	139	36 00	40 22	38 70
12	55	20	30 00	32 93	31 85
13	62	57	24 00	25 87	25 20
14	89	63	18 00	19 05	18 60
15		147	12 00	12 46	12 00
16		12	4 00	4 05	4 00

No. 119—SAN FRANCISCO.

UNION LOAN ASSOCIATION.

(Incorporated May 6, 1881.)

E. GUNZBURGER, Secretary. ISAAC UPHAM, President.

Fiscal year ends May 8, 1899.

No. of series, 11. No. of shares, 913.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$100,950 00	Installment stock—dues	$81,060 00
Arrearages	3,314 60	Earnings apportioned	25,184 44
On shares $1,675 00		Reserve and undivided profits	1,853 59
On interest 1,623 10		Other liabilities	8,020 00
On premiums 16 50			
Cash on hand and in bank	2,031 04		
Real estate owned	9,457 77		
Other assets	364 62		
Total assets	$116,118 03	Total liabilities	$116,118 03

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$11,905 00	Overdrafts and bills payable	$212 28
Interest received	7,056 90	Loans on mortgages and stock	3,200 00
Premiums received	507 85	Interest paid	228 09
Fines received	18 00	Dues repaid — installment stock	34,620 00
Fees received	3 80	Profits repaid — installment stock	13,402 01
Loans repaid	31,700 00	Salaries	1,250 00
All other receipts	5,837 38	Taxes	1,170 55
		Other expenses	285 86
		All other disbursements	629 10
		Balance on hand and in bank	2,031 04
Total receipts	$57,028 93	Total disbursements	$57,028 93

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
8	218	208	$132 00	$185 96	$175 17
9	183	153	120 00	160 53	152 42
10	176	156	108 00	138 68	126 40
11	98	88	96 00	119 13	107 56
12	9	5	84 00	101 51	92 75
13	14	2	72 00	84 88	78 44
14	43	43	60 00	68 84	61 77
15	18	12	48 00	53 66	49 13
16	100	60	36 00	38 86	36 57
17	162	153	24 00	25 27	25 25
18	------	33	12 00	12 33	12 07

No. 120—SAN FRANCISCO.

WESTERN LOAN ASSOCIATION.

(Incorporated November 12, 1886.)

E. GUNSBURGER, Secretary. D. SAMUELS, President.

Fiscal year ends November 19, 1898.

No. of series, 11. No. of shares, 1,256.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$106,100 00	Installment stock—dues	$91,436 00
Arrearages		8,879 80	Earnings apportioned	33,497 47
On shares	$4,615 00		Advance payments	211 50
On interest	2,879 55		Reserve and undivided profits	3,993 34
On premiums	1,385 25		Other liabilities	1,147 56
Cash on hand and in bank		1,152 48		
Real estate owned		14,024 84		
Other assets		128 75		
Total assets		$130,285 87	Total liabilities	$130,285 87

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$16,178 50	Overdrafts and bills payable	$1,069 14
Interest received	7,645 15	Loans on mortgages and stock	12,800 00
Premiums received	3,166 65	Interest paid	47 63
Fines received	260 45	Dues repaid — installment stock	27,440 70
Fees received	11 50	Profits repaid — installment stock	9,819 60
Loans repaid	21,510 70	Salaries	1,767 50
All other receipts	10,846 80	Taxes	1,274 04
		Other expenses	303 50
		All other disbursements	3,945 16
		Balance on hand and in bank	1,152 48
Total receipts	$59,619 75	Total disbursements	$59,619 75

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	84	8	$130 00	$200 00	$200 00
3	72	62	120 00	180 70	165 53
4	199	167	108 00	157 21	142 45
5	211	179	96 00	134 92	121 30
6	344	247	84 00	113 84	101 90
7	197	172	72 00	93 97	82 98
8	134	130	60 00	75 30	67 65
9	35	30	48 00	57 83	52 91
10	59	35	36 00	41 56	38 78
11	131	116	24 00	26 50	25 25
12	----------	110	12 00	12 65	12 33

No. 121—SAN FRANCISCO.

CALIFORNIA HOME BUILDING-LOAN COMPANY.

(Incorporated July 8, 1889.)

FRED WARD, Secretary. J. L. M. SHETTERLY, President.

Fiscal year ends July 15, 1898.

No. of series, 4. No. of shares, 44.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$575 00	Installment stock—dues	$1,033 00
Arrearages		3 15	Reserve and undivided profits	59 37
On shares	$3 00		Other liabilities	176 00
On fines, etc.	15			
Cash on hand and in bank		690 22		
Total assets		$1,268 37	Total liabilities	$1,268 37

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$524 07	Dues repaid — installment stock	$214 00
Installment stock—dues	312 00	Other expenses	10 25
Fines received	40	All other disbursements	72 00
All other receipts	150 00	Balance on hand and in bank	690 22
Total receipts	$986 47	Total disbursements	$986 47

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	30	10	$27 00	$27 00	$27 00
2	6	6	26 40	26 40	26 40
3	6	1	26 00	26 00	26 00
4	37	27	11 50	11 50	11 50

No. 122—SAN FRANCISCO.

CALIFORNIA GUARANTEE INVESTMENT COMPANY.

(Incorporated August 2, 1890.)

JNO. W. BUTLER, Secretary. H. M. A. MILLER, President.

Fiscal year ends August 31, 1898.

No. of series, 28. No. of shares, 3,055.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$191,621 00	Installment stock—dues	$67,159 96
Arrearages		4,469 62	Paid-up and prepaid stock	180,625 00
On shares	$1,330 68		Earnings apportioned	27,562 18
On interest	2,096 86		Other liabilities	4,349 55
On premiums	1,042 08			
Cash on hand and in bank		207 81		
Real estate owned		83,279 63		
Other assets		118 63		
Total assets		$279,696 69	Total liabilities	$279,696 69

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$11,010 53	Loans on mortgages and stock	$37,820 75
Installment stock—dues	11,574 16	Interest paid	3,465 80
Paid-up and prepaid stock	11,695 00	Dues repaid — installment stock	51,113 70
Interest received	14,474 53	Profits repaid — installment stock	19,464 04
Premiums received	4,793 36	Paid-up and prepaid stock	53,761 00
Fines received	24 75	Salaries	4,737 86
Loans repaid	168,335 89	Taxes	2,532 59
All other receipts	45,326 64	Other expenses	1,896 28
		All other disbursements	92,235 03
		Balance on hand and in bank	207 81
Total receipts	$267,234 86	Total disbursements	$267,234 86

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
96	$49 92	$74 52	$68 36
90	46 80	66 22	61 36
84	43 68	58 95	55 13
78	40 56	52 53	49 53
72	37 44	46 80	44 46

No. 123—SAN FRANCISCO.

PACIFIC COAST SAVINGS SOCIETY.

(Incorporated January 26, 1891.)

W. P. HENRY, Secretary. WENDELL EASTON, President.

Fiscal year ends December 31, 1898.

No. of series, none. No. of shares, 18,943.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$310,626 14	Installment stock—dues	$319,074 00
Arrearages		6,815 38	Paid-up and prepaid stock	68,650 00
On interest	$2,301 00		Earnings apportioned	42,092 57
On premiums	1,705 53		Overdrafts and bills payable—(debenture bonds)	100,000 00
On fines, etc.	2,808 85		Reserve and undivided profits	5,189 29
Cash on hand and in bank		43,768 68		
Real estate owned		91,091 80		
Other assets		82,703 86		
Total assets		$535,005 86	Total liabilities	$535,005 86

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$43,799 94	Loans on mortgages and stock	$68,549 00
Installment stock—dues	138,712 35	Interest paid	5,000 00
Paid-up and prepaid stock	8,022 27	Dues repaid — installment stock	128,094 00
Interest received	20,058 00	Profits repaid — installment stock	26,000 11
Premiums received	16,100 81	Paid-up and prepaid stock	36,000 00
Fines received	520 91	Salaries	5,730 37
Fees received	443 15	Taxes	4,980 32
Loans repaid	97,496 30	Other expenses	12,841 16
All other receipts	11,949 31	All other disbursements	6,139 40
		Balance on hand and in bank	43,768 68
Total receipts	$337,103 04	Total disbursements	$337,103 04

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
90	$54 00	$72 82	$69 02
84	50 40	63 86	60 83
78	46 80	57 40	54 75
72	43 20	52 04	49 83
66	39 60	46 35	44 51
60	36 00	41 86	39 39
54	32 40	36 95	35 85
48	28 80	32 38	31 48
42	25 20	27 73	26 73
36	21 60	23 47	22 47
30	18 00	19 29	18 29
24	14 40	15 22	14 22
18	10 80	11 23	10 25
12	7 20	7 39	6 39
6	3 60	3 65	2 65

No. 124—SAN FRANCISCO.

PACIFIC STATES SAVINGS, LOAN, AND BUILDING COMPANY.

(Incorporated July, 1889.)

WM. PARDY, Secretary. JOHN H. WISE, President.

Fiscal year ends July 31, 1898.

No. of series, 104. No. of shares, 46,053.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$1,040,033 60	Installment stock—dues	$794,373 44
Arrearages		16,986 21	Paid-up and prepaid stock	149,925 65
On shares	$7,291 68		Earnings apportioned	253,051 89
On interest	4,847 00		Advance payments	8,003 72
On premiums	4,847 53		Reserve and undivided profits	36,630 41
Cash on hand and in bank		70,180 56	Other liabilities	31,883 48
Real estate owned		130,274 43		
Other assets		16,393 79		
Total assets		$1,273,868 59	Total liabilities	$1,273,868 59

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$76,690 99	Loans on mortgages and stock	$243,720 88
Installment stock—dues	262,819 78	Interest paid—paid-up and prepaid stock, etc.	7,755 27
Paid-up and prepaid stock	62,090 00	Dues repaid — installment stock	323,660 32
Interest received	78,234 05	Profits repaid — installment stock	132,069 30
Premiums received	37,353 64	Paid-up and prepaid stock	10,960 00
Fines received	3,434 75	Salaries	17,735 00
Fees received	9 00	Taxes	12,236 39
Loans repaid	321,906 17	Other expenses	10,942 27
All other receipts	79,987 70	All other disbursements	93,266 09
		Balance on hand and in bank	70,180 56
Total receipts	$922,526 08	Total disbursements	$922,526 08

INSTALLMENT STOCK, CLASS "A," WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE AT AGES INDICATED.

Age, in Months.	Net Dues per Share.	Book Value per Share.	Withdrawal Value.
102	$53 04	$92 97	$92 97
96	49 92	82 33	82 33
90	46 80	73 30	73 30
84	43 68	65 62	63 42
78	40 56	58 51	56 71
72	37 44	52 04	48 39
66	34 32	46 04	43 11
60	31 20	40 50	38 18
54	28 08	35 33	33 52
48	24 96	30 53	29 14
42	21 84	26 01	24 97
36	18 72	21 72	20 97
30	15 60	17 57	17 08
24	12 48	13 62	13 33
18	9 36	10 00	9 84
12	6 24	6 54	6 46
6	3 12	3 20	3 18

No. 125—SAN FRANCISCO.

RENTERS COÖPERATIVE INVESTMENT COMPANY.

(Incorporated November 24, 1890.)

GRANT CORDREY, Secretary. G. M. PERINE, President.

Fiscal year ends December 31, 1898.

No. of series, 96. No. of shares, 21,012.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$386,725 00	Installment stock—dues	$216,432 00
Arrearages		7,304 69	Paid-up and prepaid stock	89,007 81
On shares	$4,495 50		Earnings apportioned	55,316 28
On interest	1,281 79		Advance payments	3,318 32
On premiums	1,527 05		Overdrafts and bills payable	31,705 93
On fines, etc.	35		Reserve and undivided profits	1,351 86
Real estate owned		5,248 00	Other liabilities	11,341 53
Other assets		9,196 04		
Total assets		$408,473 73	Total liabilities	$408,473 73

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$110,452 19	Overdrafts and bills payable	$96,851 50
Paid-up and prepaid stock	52,250 00	Loans on mortgages and stock	122,324 43
Interest received	20,663 66	Interest paid	6,560 24
Premiums received	19,982 70	Dues repaid — installment stock	53,764 50
Fines received	238 54	Profits repaid — installment stock	11,062 46
Loans repaid	54,815 00	Paid-up and prepaid stock	7,432 58
Overdrafts and bills payable	40,705 93	Salaries	11,060 00
All other receipts	35,399 52	Taxes	5,055 92
		Other expenses	12,997 99
		All other disbursements	7,397 92
Total receipts	$334,507 54	Total disbursements	$334,507 54

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
96	$48 00	$96 17	
90	45 00	73 75	
84	42 00	67 12	
78	39 00	61 22	
72	36 00	52 13	
66	33 00	47 49	Loan Fund dues plus three fourths of added profits.
60	30 00	40 60	
54	27 00	37 01	
48	24 00	31 82	
42	21 00	25 67	
36	18 00	22 50	
30	15 00	18 76	
24	12 00	13 45	
18	9 00	9 76	
12	6 00	6 32	
6	3 00	3 08	

No. 126—SAN FRANCISCO.

PROGRESS MUTUAL LOAN ASSOCIATION.

(Incorporated January, 1895.)

D. HIRSCHFELD, Secretary. E. K. CHAPMAN, President.

Fiscal year ends December 31, 1898.

No. of series, 4. No. of shares, 1,080.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$46,775 00	Installment stock—dues	$42,120 00
Arrearages		287 85	Earnings apportioned	6,173 22
On shares	$121 00		Advance payments	16 00
On interest	119 10		Reserve and undivided profits	227 35
On premiums	47 75		Unearned premiums	102 00
Cash on hand and in bank		1,497 49		
Other assets		78 23		
Total assets		$48,638 57	Total liabilities	$48,638 57

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$18 09	Overdrafts and bills payable	$6,937 72
Installment stock—dues	13,389 00	Loans on mortgages and stock	10,400 00
Interest received	3,662 49	Interest paid	143 17
Premiums received	1,449 15	Dues repaid — installment stock	5,679 00
Fines received	42 40	Profits repaid — installment stock	350 44
Fees received	7 10	Paid-up and prepaid stock	7,000 00
Loans repaid	10,745 00	Salaries	720 00
All other receipts	4,833 60	Taxes	707 06
		Other expenses	138 50
		All other disbursements	573 45
		Balance on hand and in bank	1,497 49
Total receipts	$34,146 83	Total disbursements	$34,146 83

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	860	713	$48 00	$55 70	$51 35
2	78	78	36 00	40 36	38 20
3	135	135	24 00	25 96	25 00
4		154	12 00	12 51	12 25

No. 127—SAN FRANCISCO.

BORROWERS MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated February, 1896.)

CHAS. E. NAYLOR, Secretary. F. H. McCORMICK, President.

Fiscal year ends January 31, 1899.

No. of series, 8. No. of shares, 271.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$7,000 00	Installment stock—dues	$3,464 00
Arrearages		193 75	Paid-up and prepaid stock	1,200 00
On shares	$77 50		Earnings apportioned	460 43
On interest	116 25		Other liabilities	2,212 80
Cash on hand and in bank		79 48		
Other assets		64 00		
Total assets		$7,337 23	Total liabilities	$7,337 23

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$680 17	Loans on mortgages and stock	$50 00
Installment stock—dues	1,810 50	Interest paid	361 27
Interest received	523 25	Dues repaid — installment stock	756 50
Fines received	16 05	Profits repaid—installment stock	34 75
Fees received	5 20	Taxes	107 67
Loans repaid	50 00	Other expenses	73 50
		All other disbursements	1,622 00
		Balance on hand and in bank	79 48
Total receipts	$3,085 17	Total disbursements	$3,085 17

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	139	109	$36 00	$36 00	$36 00
3	30	10	30 00	30 00	30 00
5	20	20	24 00	24 00	24 00
6	100	60	21 00	21 00	21 00
8	30	30	15 00	15 00	15 00
9		30	12 00	12 00	12 00
10		2	9 00	9 00	9 00
12		10	3 00	3 00	3 00

No. 128—SAN FRANCISCO.

RICHMOND MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated July 31, 1897.)

W. H. DAVIS, Secretary. H. P. UMBSEN, President.

Fiscal year ends July 31, 1898.

No. of series, 2. No. of shares, 449.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$16,650 00	Installment stock—dues	$4,512 00
		Earnings apportioned	257 69
		Overdrafts and bills payable	11,878 96
		Reserve and undivided profits	1 35
Total assets	$16,650 00	Total liabilities	$16,650 00

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$4,540 00	Overdrafts and bills payable	$2,225 00
Interest received	633 08	Loans on mortgages and stock	17,450 00
Premiums received	295 90	Interest paid	339 62
Fines received	2 67	Dues repaid — installment stock	28 00
Fees received	44 30	Taxes	5 09
Loans repaid	800 00	Other expenses	372 20
Overdrafts and bills payable	14,103 96		
Total receipts	$20,419 91	Total disbursements	$20,419 91

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1		303	$12 00	$12 73	$12 39
2		146	6 00	6 25	6 10

No. 129—SAN FRANCISCO.

CONTINENTAL BUILDING AND LOAN ASSOCIATION.

(Incorporated July 17, 1889.)

WM. CORBIN, Secretary. ED. E. HILL, President.

Fiscal year ends June 30, 1898.

No. of series, none. No. of shares, 70,058.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$912,925 10	Installment stock—dues	$399,314 68
Arrearages		15,144 75	Paid-up and prepaid stock	324,527 40
On interest	$7,672 75		Earnings apportioned	97,877 45
On premiums	7,472 00		Advance payments	12,065 63
Cash on hand and in bank		74 50	Overdrafts and bills payable	63,110 75
Real estate owned		31,117 98	Reserve and undivided profits	9,900 00
Other assets		23,481 43	Other liabilities	75,947 85
Total assets		$982,743 76	Total liabilities	$982,743 76

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$72 54	Overdrafts and bills payable	$3,431 13
Installment stock—dues	232,583 73	Loans on mortgages and stock	482,971 03
Paid-up and prepaid stock	313,861 13	Interest paid	960 13
Interest received	33,897 04	Dues repaid — installment stock	100,233 09
Premiums received	37,093 90	Profits repaid — installment stock	11,553 07
Fines received	1,376 06	Paid-up and prepaid stock	139,842 74
Fees received	186 40	Salaries	8,260 00
Loans repaid	104,166 71	Taxes	5,414 07
Overdrafts and bills payable	62,594 75	Other expenses	30,526 34
All other receipts	55,004 73	All other disbursements	57,570 89
		Balance on hand and in bank	74 50
Total receipts	$840,836 99	Total disbursements	$840,836 99

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE AT AGES INDICATED.

Age, in Months.	Book Value per Share.	Withdrawal Value.
105	$100 00	$100 00
102	96 52	85 14
96	76 50	68 63
84	67 27	60 96
72	47 83	44 24
66	40 70	37 90
48	30 50	28 90
42	26 00	24 75
36	21 60	20 70
30	17 43	16 82
24	13 64	13 23
18	9 83	9 40
12	6 35	6 18
6	3 04	3 00

No. 130—SAN FRANCISCO.

GLOBE MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated March 30, 1898.)

FRED H. CLARK, Secretary. FRANK OTIS, President.

Fiscal year ends March 31, 1899.

No. of series, 2. No. of shares, 1,980.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$15,150 00	Installment stock—dues	$11,205 00
Cash on hand and in bank	26 85	Earnings apportioned	344 70
Other assets	173 65	Advance payments	784 00
		Reserve and undivided profits	15 45
		Other liabilities	3,001 35
Total assets	$15,350 50	Total liabilities	$15,350 50

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$11,973 00	Overdrafts and bills payable	$1,000 00
Interest received	407 30	Loans on mortgages and stock	12,148 65
Fines received	50	Dues repaid — installment stock	60 00
Fees received	98 65	Other expenses	93 10
Overdrafts and bills payable	1,000 00	All other disbursements	173 65
All other receipts	22 80	Balance on hand and in bank	26 85
Total receipts	$13,502 25	Total disbursements	$13,502 25

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1		1,755	$6 00	$6 19	$6 10
2		225	3 00	3 05	3 00

No. 131—SAN JOSÉ.

MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated March 12, 1889.)

GEORGE N. JONES, Secretary. JAMES BEAN, President.

Fiscal year ends September 30, 1898.

No. of series, 17. No. of shares, 1,828½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$122,836 00	Installment stock—dues	$95,778 00
Arrearages		1,552 10	Earnings apportioned	33,925 30
On shares	$791 00		Advance payments	1,411 00
On interest	620 00		Reserve and undivided profits	43 34
On fines, etc.	141 10		Unearned premiums	6,024 65
Cash on hand and in bank		7,123 88	Other liabilities	1,573 10
Real estate owned		7,243 41		
Total assets		$138,755 39	Total liabilities	$138,755 39

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,122 74	Loans on mortgages and stock	$10,542 15
Installment stock—dues	24,873 00	Dues repaid — installment stock	12,721 00
Interest received	6,701 80	Profits repaid — installment stock	2,787 47
Fines received	72 20	Salaries	736 00
Fees received	54 30	Taxes	1,322 99
Loans repaid	2,401 96	Other expenses	219 00
All other receipts	906 90	All other disbursements	680 41
		Balance on hand and in bank	7,123 88
Total receipts	$36,132 90	Total disbursements	$36,132 90

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	236	199	$114 00	$188 32	$184 00
2	57	56	102 00	155 88	145 43
3	93	83	90 00	127 75	120 37
4	207	178	84 00	114 98	110 46
5	89	89	78 00	103 13	98 28
6	50	50	72 00	92 09	89 28
7	114	104	66 00	81 88	80 52
8	35	15	60 00	72 26	72 00
9	42	42	54 00	63 25	63 72
10	142½	99½	48 00	54 82	55 68
11	68	58	42 00	46 95	47 14
12	172	116	36 00	39 41	39 78
13	180	116	30 00	32 21	32 62
14	161½	150½	24 00	25 32	25 68
15	186	137	18 00	18 70	18 81
16	------------	237½	12 00	12 34	12 36
17	------------	98	6 00	6 13	6 09

No. 132—SAN JOSÉ.

NUCLEUS BUILDING AND LOAN ASSOCIATION.

(Incorporated April, 1889.)

W. G. HAWLEY, Secretary. GEO. B. MCKEE, President.

Fiscal year ends April 1, 1899.

No. of series, 14. No. of shares, 783.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$63,942 00	Installment stock—dues	$65,453 00
Arrearages		1,214 90	Earnings apportioned	23,839 85
On shares	$608 00		Advance payments	394 65
On interest	478 00		Reserve and undivided profits	4,395 01
On premiums	41 00			
On fines, etc.	87 90			
Cash on hand and in bank		10,557 29		
Real estate owned		18,050 00		
Other assets		318 32		
Total assets		$94,082 51	Total liabilities	$94,082 51

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$11,662 29	Loans on mortgages and stock	$6,942 00
Installment stock—dues	10,168 00	Dues repaid — installment stock	14,403 00
Interest received	4,996 06	Profits repaid — installment stock	3,891 79
Premiums received	559 34	Salaries	915 00
Fines received	173 60	Taxes	962 53
Loans repaid	16,485 00	Other expenses	211 48
All other receipts	765 57	All other disbursements	6,926 77
		Balance on hand and in bank	10,557 29
Total receipts	$44,809 86	Total disbursements	$44,809 86

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	243	198	$120 00	$177 64	$168 00
2	10	5	114 00	163 25	157 32
3	97	82	107 00	150 37	140 37
4	51	51	99 00	134 13	127 58
5	93	84	95 00	127 27	117 57
6	74	34	89 00	115 85	108 80
7	74	59	83 00	106 18	100 23
8	72	57	76 00	94 40	89 70
9	10	10	68 00	82 48	77 64
10	37	22	56 00	65 09	62 20
11	43	28	45 00	50 41	48 38
12	92	68	35 00	38 30	37 03
13	56	51	23 00	24 25	23 88
14	----	34	10 00	10 25	10 00

No. 133—SAN JOSÉ.

SAN JOSÉ BUILDING AND LOAN ASSOCIATION.

(Incorporated January 30, 1885.)

FRANK V. WRIGHT, Secretary. J. M. PITMAN, President.

Fiscal year ends January 31, 1899.

No. of series, 19. No. of shares, 2,088.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$260,958 52	Installment stock—dues	$133,575 00
Arrearages		6,608 80	Paid-up and prepaid stock	31,600 00
On shares	$3,198 00		Earnings apportioned	43,357 47
On interest	3,091 00		Advance payments	78 00
On fines, etc.	319 80		Overdrafts and bills payable	60,672 00
Cash on hand and in bank		8,655 39	Reserve and undivided profits	35 17
Real estate owned		14,992 73	Unearned premiums	23,973 29
Other assets		2,130 45	Other liabilities	54 96
Total assets		$293,345 89	Total liabilities	$293,345 89

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$8,266 84	Overdrafts and bills payable	$50,195 00
Installment stock—dues	27,667 00	Loans on mortgages and stock	23,386 31
Interest received	16,744 26	Interest paid	5,508 25
Premiums received	1,010 00	Dues repaid — installment stock	43,607 00
Fines received	271 60	Profits repaid—installment stock	16,542 03
Fees received	19 00	Paid-up and prepaid stock	7,400 00
Loans repaid	70,639 91	Salaries	3,250 00
Overdrafts and bills payable	43,987 00	Taxes	3,877 99
All other receipts	10,266 33	Other expenses	970 90
		All other disbursements	15,479 07
		Balance on hand and in bank	8,655 39
Total receipts	$178,871 94	Total disbursements	$178,871 94

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
5	114	96	$120 00	$183 31	$182 00
6	184	164	108 00	157 47	142 02
7	282	260	96 00	133 75	119 04
8	361	310	84 00	112 02	101 64
9	196	158	72 00	92 09	84 96
10	369	350	60 00	73 61	69 00
11	218	145	48 00	56 57	53 76
12	130	92	36 00	40 79	39 24
13	134	121	33 00	37 10	35 64
14	2	2	30 00	33 45	32 25
15	28	23	27 00	29 78	28 82
16	115	107	24 00	26 18	25 44
17	181	66	21 00	22 76	22 10
18	105	15	18 00	19 38	18 81
19	49	39	15 00	16 00	15 57
20		60	12 00	12 65	12 36
21		28	9 00	9 49	9 00
22		28	6 00	6 36	6 00
23		24	3 00	3 23	3 00

No. 134—SAN LUIS OBISPO.

SAN LUIS BUILDING AND LOAN ASSOCIATION.

(Incorporated March 1, 1888.)

M. Lewin, Secretary. Benj. Brooks, President.

Fiscal year ends March 1, 1899.

No. of series, 8. No. of shares, 1,506.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$102,470 00	Installment stock—dues	$78,638 00
Arrearages		530 44	Earnings apportioned	24,457 80
On shares	$225 00		Advance payments	332 37
On interest	184 09		Reserve and undivided profits	464 55
On premiums	42 05		Other liabilities	239 64
On fines, etc.	79 30			
Cash on hand and in bank		1,115 67		
Other assets		16 25		
Total assets		$104,132 36	Total liabilities	$104,132 36

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$5,874 08	Loans on mortgages and stock	$17,300 00
Installment stock—dues	20,400 00	Interest paid	7 67
Interest received	7,273 83	Dues repaid — installment stock	22,425 00
Premiums received	2,422 36	Profits repaid — installment stock	6,343 77
Fines received	217 38	Salaries	1,213 32
Fees received	71 76	Taxes	1,930 33
Loans repaid	14,650 00	Other expenses	156 32
		All other disbursements	417 33
		Balance on hand and in bank	1,115 67
Total receipts	$50,909 41	Total disbursements	$50,909 41

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	81	58	$116 00	$190 44	$190 44
3	347	234	90 00	127 77	120 79
4	234	185	78 00	104 32	97 18
5	233	187	60 00	74 73	68 69
6	252	215	48 00	57 32	52 67
7	270	215	36 00	41 16	38 59
8	197	183	24 00	26 35	25 18
9	------------	229	12 00	12 59	12 30

No. 135—SAN MATEO.

SAN MATEO MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated May 2, 1896.)

C. H. KIRKBRIDE, Secretary. E. A. HUSING, President.

Fiscal year ends December 31, 1898.

No. of series, 10. No. of shares, 580.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$13,270 00	Installment stock—dues	$11,560 00
Arrearages		185 15	Earnings apportioned	1,155 00
On shares	$101 00		Advance payments	572 30
On interest	50 00		Reserve and undivided profits	147 83
On premiums	18 75		Unearned premiums	56 62
On fines, etc.	15 40		Other liabilities	234 33
Cash on hand and in bank		270 93		
Total assets		$13,726 08	Total liabilities	$13,726 08

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$318 36	Overdrafts and bills payable	$4,350 00
Installment stock—dues	7,293 00	Loans on mortgages and stock	4,660 16
Interest received	917 45	Interest paid	95 36
Premiums received	340 45	Dues repaid — installment stock	2,932 00
Fines received	17 40	Profits repaid — installment stock	134 01
Fees received	22 40	Salaries	147 50
Loans repaid	1,350 00	Taxes	135 12
Overdrafts and bills payable	2,500 00	Other expenses	18 98
		All other disbursements	15 00
		Balance on hand and in bank	270 93
Total receipts	$12,759 06	Total disbursements	$12,759 06

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	198	163	$31 00	$34 90	$33 48
2	88	63	27 00	29 92	28 89
3	93	65	24 00	26 30	25 50
4	95	47	21 00	22 76	22 15
5	26	16	18 00	19 30	18 85
6	19	15	15 00	15 91	15 60
7	------------	54	12 00	12 58	12 39
8	------------	93	9 00	9 34	9 00
9	------------	23	6 00	6 16	6 00
10	------------	41	3 00	3 05	3 00

No. 136—SAN RAFAEL.

MARIN COUNTY MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated July 19, 1886.)

L. A. LANCEL, Secretary. H. P. WOOD, President.

Fiscal year ends July 31, 1898.

No. of series, 9. No. of shares, 2,157.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$125,500 00	Installment stock—dues	$90,384 00
Arrearages		310 50	Earnings apportioned	29,818 61
On shares	$76 00		Advance payments	685 35
On interest	88 65		Overdrafts and bills payable	3,544 08
On premiums	37 60		Reserve and undivided profits	218 88
On fines, etc.	108 25		Other liabilities	1,191 48
Other assets		31 90		
Total assets		$125,842 40	Total liabilities	$125,842 40

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$27,173 00	Overdrafts and bills payable	$786 17
Interest received	8,571 50	Loans on mortgages and stock	26,996 00
Premiums received	4,299 30	Interest paid	421 72
Fines received	119 75	Dues repaid — installment stock	20,769 00
Fees received	70 40	Profits repaid — installment stock	7,246 43
Loans repaid	15,200 00	Salaries	1,080 00
Overdrafts and bills payable	3,544 08	Taxes	1,578 08
All other receipts	20 45	Other expenses	90 88
		All other disbursements	30 20
Total receipts	$58,998 48	Total disbursements	$58,998 48

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	42	40	$108 00	$183 00	$179 25
5	196	63	96 00	153 06	147 36
6	190	158	84 00	125 86	117 49
7	252	231	72 00	101 37	92 56
8	168	134	60 00	79 72	71 83
9	233	208	48 00	60 30	54 15
10	460	460	36 00	42 68	39 34
11	441	431	24 00	26 90	25 45
12	------------	432	12 00	12 70	12 35

No. 137—SANTA ANA.

HOME MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated April 1, 1893.)

F. W. MANSUR, Secretary. JOHN MCFADDEN, President.

Fiscal year ends December 31, 1898.

No. of series, 5. No. of shares, 1,630½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$90,044 00	Installment stock—dues	$71,780 00
Arrearages		70 05	Earnings apportioned	17,048 97
On shares	$42 00		Reserve and undivided profits	628 20
On interest	28 05		Unearned premiums	1,402 80
Cash on hand and in bank		745 92		
Total assets		$90,859 97	Total liabilities	$90,859 97

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$35 04	Overdrafts and bills payable	$5,800 00
Installment stock—dues	20,413 00	Loans on mortgages and stock	19,084 00
Interest received	6,752 88	Interest paid	165 43
Premiums received	308 86	Dues repaid — installment stock	5,455 00
Fines received	28 35	Profits repaid — installment stock	920 44
Fees received	32 55	Salaries	412 50
Loans repaid	4,075 00	Taxes	1,118 54
Overdrafts and bills payable	1,150 00	Other expenses	116 49
All other receipts	1,036 39	All other disbursements	13 75
		Balance on hand and in bank	745 92
Total receipts	$33,832 07	Total disbursements	$33,832 07

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	582½	533½	$68 00	$87 83	$79 90
2	476½	434½	48 00	58 30	53 15
3	143½	140½	36 00	42 16	39 08
4	297	277	24 00	27 12	25 56
5	----	245	12 00	13 08	12 60

No. 138—SANTA BARBARA.

LOAN AND BUILDING ASSOCIATION.

(Incorporated May 23, 1887.)

J. T. JOHNSON, Secretary. H. L. STAMBACH, President.

Fiscal year ends July 26, 1898.

No. of series, 9. No. of shares, 2,746.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$129,544 00	Installment stock—dues	$103,920 00
Arrearages		2,295 65	Earnings apportioned	22,805 90
On shares	$890 00		Advance payments	556 00
On interest	1,232 40		Reserve and undivided profits	49 54
On premiums	18 15		Other liabilities	8,550 00
On fines, etc.	155 10			
Cash on hand and in bank		2,706 64		
Real estate owned		1,255 15		
Other assets		80 00		
Total assets		$135,881 44	Total liabilities	$135,881 44

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,006 72	Overdrafts and bills payable	$2,761 50
Installment stock—dues	33,194 00	Loans on mortgages and stock	28,135 00
Interest received	11,175 75	Interest paid	309 75
Premiums received	396 10	Dues repaid—installment stock	22,047 00
Fines received	162 45	Profits repaid—installment stock	9,431 30
Fees received	90 90	Salaries	800 00
Loans repaid	18,700 00	Taxes	2,973 90
All other receipts	6,400 00	Other expenses	205 68
		All other disbursements	1,755 15
		Balance on hand and in bank	2,706 64
Total receipts	$71,125 92	Total disbursements	$71,125 92

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	76	53	$114 00	$176 85	$176 85
3	97	79	90 00	124 90	124 90
4	270	255	78 00	102 30	99 90
5	291	259	66 00	82 15	80 55
6	236	216	54 00	64 45	62 35
7	331	296	42 00	48 05	46 20
8	563	512	30 00	32 90	30 45
9	701	656	18 00	19 10	18 66
10	....	420	6 00	6 20	6 12

No. 139—SANTA CLARA.

SANTA CLARA BUILDING AND LOAN ASSOCIATION.

(Incorporated March 19, 1889.)

F. O. RALL, Secretary. J. B. O'BRIEN, President.

Fiscal year ends March 31, 1899.

No. of series, 10. No. of shares, 1,163.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$118,123 10	Installment stock—dues	$77,778 00
Arrearages		1,067 70	Earnings apportioned	31,239 49
On shares	$504 00		Advance payments	193 00
On interest	433 50		Reserve and undivided profits	1,064 72
On fines, etc.	130 20		Unearned premiums	10,033 13
Cash on hand and in bank		107 97	Other liabilities	544 53
Real estate owned		1,500 00		
Other assets		54 10		
Total assets		$120,852 87	Total liabilities	$120,852 87

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,359 26	Loans on mortgages and stock	$19,700 00
Installment stock—dues	14,842 00	Interest paid	37 50
Interest received	6,772 15	Dues repaid — installment stock	11,493 00
Premiums received	4,400 00	Profits repaid — installment stock	3,463 54
Fines received	47 80	Salaries	630 00
Loans repaid	9,000 00	Taxes	1,277 59
All other receipts	518 15	Other expenses	76 75
		All other disbursements	1,153 01
		Balance on hand and in bank	107 97
Total receipts	$37,939 36	Total disbursements	$37,939 36

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	306½	258½	$120 00	$183 00	$183 00
2	109	107	108 00	159 03	151 00
3	83	61	96 00	136 32	130 00
4	86	81	84 00	114 87	109 00
5	63	63	72 00	94 68	89 00
6	89	62	60 00	75 75	70 50
7	146	111	48 00	58 08	53 00
8	106	101	36 00	41 67	38 00
9	146	125	24 00	26 52	24 50
10	----	193½	12 00	12 63	12 25

No. 140—SANTA PAULA.

SANTA PAULA BUILDING AND LOAN ASSOCIATION.

(Incorporated April 21, 1890.)

H. H. YOUNGKEN, Secretary. J. R. HOUGH, President.

Fiscal year ends May 12, 1899.

No. of series, 9. No. of shares, 1,355.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$62,200 00	Installment stock—dues	$48,233 08
Arrearages		454 01	Earnings apportioned	12,062 52
On shares	$240 52		Advance payments	157 64
On interest	167 34		Unearned premiums	3,640 20
On fines, etc.	46 15			
Cash on hand and in bank		632 64		
Real estate owned		608 30		
Other assets		198 49		
Total assets		$64,093 44	Total liabilities	$64,093 44

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$517 31	Loans on mortgages and stock	$10,500 00
Installment stock—dues	16,851 98	Dues repaid — installment stock	9,868 62
Interest received	4,816 34	Profits repaid — installment stock	3,740 19
Premiums received	1,409 25	Salaries	600 00
Fines received	188 66	Taxes	539 72
Fees received	47 02	Other expenses	88 79
Loans repaid	2,400 00	All other disbursements	333 40
All other receipts	72 80	Balance on hand and in bank	632 64
Total receipts	$26,303 36	Total disbursements	$26,303 36

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	275	193	$71 56	$100 00	$100 00
5	161	161	60 00	78 64	78 64
6	111	111	48 00	59 32	55 36
7	174	174	36 00	42 11	39 36
7½	60	54	30 00	34 15	32 33
8	299	289	24 00	26 62	25 50
8½	61	54	18 00	19 46	18 85
9	------------	288	12 00	12 65	12 39
9½	------------	31	6 00	6 18	6 10

No. 141—SANTA ROSA.

SANTA ROSA BUILDING AND LOAN ASSOCIATION.

(Incorporated October 6, 1888.)

J. W. FARNHAM, Secretary. ALLEN B. LEMMON, President.

Fiscal year ends October 31, 1898.

No. of series, 10. No. of shares, 1,691½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$127,130 00	Installment stock—dues	$100,812 00
Arrearages		1,124 10	Earnings apportioned	37,901 44
On shares	$628 50		Reserve and undivided profits	1 75
On interest	373 40		Other liabilities	613 90
On premiums	20 00			
On fines, etc.	102 20			
Cash on hand and in bank		9,671 39		
Real estate owned		1,358 00		
Other assets		45 60		
Total assets		$139,329 09	Total liabilities	$139,329 09

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$9,737 71	Loans on mortgages and stock	$26,220 00
Installment stock—dues	20,692 50	Dues repaid — installment stock	12,120 50
Interest received	8,721 40	Profits repaid—installment stock	4,255 40
Premiums received	2,376 20	Salaries	534 45
Fines received	19 75	Taxes	3,055 21
Fees received	32 50	Other expenses	96 86
Loans repaid	14,820 00	All other disbursements	529 65
All other receipts	83 40	Balance on hand and in bank	9,671 39
Total receipts	$56,483 46	Total disbursements	$56,483 46

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	467	412	$120 00	$188 10	$187 10
2	52	37	108 00	159 66	146 88
3	9	9	96 00	135 34	126 72
4	56	53	84 00	111 92	107 52
5	84	70	72 00	90 53	88 20
6	172	172	60 00	72 16	70 50
7	263½	206½	48 00	55 18	54 24
8	262½	229	36 00	39 53	39 24
9	301½	209	24 00	25 50	25 32
10	-----------	294	12 00	12 36	12 30

No. 142—SAUSALITO.

SAUSALITO MUTUAL LOAN ASSOCIATION.

(Incorporated December 1, 1889.)

THOS. PENLINGTON, Secretary. O. C. MILLER, President.

Fiscal year ends October 31, 1898.

No. of series, 7. No. of shares, 804.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$28,725 00	Installment stock—dues	$28,914 00
Arrearages		442 41	Earnings apportioned	5,877 70
On shares	$233 00		Reserve and undivided profits	1 72
On interest	121 46			
On premiums	46 00			
On fines, etc.	41 95			
Cash on hand and in bank		1,403 88		
Real estate owned		4,182 73		
Other assets		39 40		
Total assets		$34,793 42	Total liabilities	$34,793 42

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$862 71	Overdrafts and bills payable	$4,800 00
Installment stock—dues	10,798 00	Loans on mortgages and stock	10,750 00
Interest received	2,691 63	Interest paid	102 61
Premiums received	1,000 73	Dues repaid — installment stock	13,349 00
Fines received	174 81	Profits repaid — installment stock	3,292 47
Fees received	22 00	Salaries	480 00
Loans repaid	17,350 00	Taxes	473 06
Overdrafts and bills payable	2,300 00	Other expenses	106 08
All other receipts	2,873 64	All other disbursements	3,316 42
		Balance on hand and in bank	1,403 88
Total receipts	$38,073 52	Total disbursements	$38,073 52

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
6	103	36	$72 00	$96 58	$94 13
7	176	148	60 00	76 13	72 91
8	152	142	48 00	57 78	54 85
9	180	143	36 00	41 38	39 23
10	192	151	24 00	26 37	25 19
11		125	12 00	12 58	12 00
1B		59	6 00	6 29	6 00

No. 143—SAUSALITO.

TAMALPAIS MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated March 20, 1897.)

JULIAN B. HARRIES, Secretary. T. W. JACKSON, President.

Fiscal year ends April 30, 1899.

No. of series, 3. No. of shares, 88.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$1,300 00	Installment stock—dues	$1,866 00
Arrearages		402 67	Paid-up and prepaid stock	100 00
On shares	$356 00			
On interest	32 67			
On premiums	14 00			
Cash on hand and in bank		260 33		
Other assets		3 00		
Total assets		$1,966 00	Total liabilities	$1,966 00

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$542 13	Loans on mortgages and stock	$1,300 00
Installment stock—dues	870 00	Interest paid	3 00
Paid-up and prepaid stock	100 00	Other expenses	13 86
Interest received	46 11	All other disbursements	22 00
Premiums received	17 75	Balance on hand and in bank	260 33
Fees received	1 20		
All other receipts	22 00		
Total receipts	$1,599 19	Total disbursements	$1,599 19

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	7	70	$24 00	$24 00	$24 00
2		13	12 00	12 00	12 00
3		5	6 00	6 00	6 00

No. 144—STOCKTON.

SAN JOAQUIN BUILDING AND LOAN ASSOCIATION.

(Incorporated June 17, 1889.)

A. M. Noble, Secretary. S. N. Cross, President.

Fiscal year ends July 31, 1898.

No. of series, 6. No. of shares, 1,584.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$146,290 02	Installment stock—dues	$115,548 50
Arrearages		2,069 40	Earnings apportioned	55,067 02
On shares	$440 00		Reserve and undivided profits	1,046 84
On interest	1,533 40		Unearned premiums	6,349 69
On premiums	7 50			
On fines, etc.	88 50			
Cash on hand and in bank		725 13		
Real estate owned		28,621 84		
Other assets		315 66		
Total assets		$178,012 05	Total liabilities	$178,012 05

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,263 64	Loans on mortgages and stock	$26,064 60
Installment stock—dues	21,366 00	Interest paid	50
Interest received	10,354 23	Dues repaid — installment stock	28,694 00
Premiums received	630 20	Profits repaid — installment stock	10,310 26
Fines received	343 60	Salaries	1,397 50
Fees received	22 40	Taxes	2,383 10
Loans repaid	37,423 81	Other expenses	1,059 10
All other receipts	11,451 61	All other disbursements	13,221 30
		Balance on hand and in bank	725 13
Total receipts	$83,855 49	Total disbursements	$83,855 49

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	814½	645½	$108 00	$169 66	$169 66
2	304	232	95 00	140 24	121 03
3	275	222	63 00	80 20	74 37
4	156½	109½	35 00	39 54	37 97
5	248	269½	21 00	22 67	22 05
6	----------	105½	3 00	3 04	3 01

No. 145—STOCKTON.

STOCKTON LAND, LOAN, AND BUILDING ASSOCIATION.

(Incorporated January 3, 1887.)

R. E. Wilhoit, Secretary. J. D. Young, President.

Fiscal year ends January 31, 1899.

No. of series, 11. No. of shares, 4,213½.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$539,138 61	Installment stock—dues	$391,149 00
Arrearages		12,933 85	Earnings apportioned	169,029 68
On shares	$3,106 50		Advance payments	139 50
On interest	9,279 25		Reserve and undivided profits	3,150 03
On premiums	32 50		Unearned premiums	22,683 43
On fines, etc.	515 60			
Cash on hand and in bank		19,122 85		
Real estate owned		12,509 89		
Other assets		2,446 44		
Total assets		$586,151 64	Total liabilities	$586,151 64

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$29,637 66	Loans on mortgages and stock	$71,568 24
Installment stock—dues	52,351 50	Dues repaid — installment stock	57,391 00
Interest received	32,057 97	Profits repaid — installment stock	23,234 60
Premiums received	1,014 42	Salaries	1,850 00
Fines received	362 90	Taxes	6,231 82
Fees received	22 00	Other expenses	217 30
Loans repaid	67,457 31	All other disbursements	5,730 87
All other receipts	2,442 92	Balance on hand and in bank	19,122 85
Total receipts	$185,346 68	Total disbursements	$185,346 68

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	1,013	686	$120 00	$185 80	$185 80
3	1,053	971½	108 00	158 44	142 00
4	929	874	102 00	146 12	132 10
5	646	579	96 00	133 82	122 75
6	211	211	84 00	111 54	104 50
7	269	259	72 00	91 28	87 00
8	164	147	60 00	72 80	70 35
9	149	149	48 00	55 92	54 65
10	97	93	31 00	34 38	33 35
11	95	85	24 00	25 96	25 30
12		159	12 00	12 52	12 35

No. 146—TULARE.

TULARE BUILDING AND LOAN ASSOCIATION.

(Incorporated January, 1889.)

H. M. SHREVE, Secretary. WM. MOLLER, President.

Fiscal year ends December 31, 1898.

No. of series, 9. No. of shares, 707.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$69,919 15	Installment stock—dues	$50,595 50
Arrearages		2,576 22	Earnings apportioned	26,444 96
On shares	$1,520 34		Advance payments	805 78
On interest	807 92		Overdrafts and bills payable	11,895 89
On premiums	31 08		Reserve and undivided profits	1,826 93
On fines, etc.	216 88		Unearned premiums	4,116 03
Real estate owned		22,914 42	Other liabilities	31 70
Other assets		307 00		
Total assets		$95,716 79	Total liabilities	$95,716 79

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$8,176 32	Overdrafts and bills payable	$1,813 11
Interest received	6,376 47	Interest paid	784 72
Fines received	1,013 15	Dues repaid — installment stock	24,622 00
Fees received	12 50	Profits repaid — installment stock	13,489 36
Loans repaid	18,350 00	Salaries	774 19
Overdrafts and bills payable	11,895 89	Taxes	1,448 66
All other receipts	4,171 34	Other expenses	697 99
		All other disbursements	6,365 64
Total receipts	$49,995 67	Total disbursements	$49,995 67

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	290½	101	$112 00	$200 00	$200 00
2	88	65½	102 00	181 60	161 70
3	126	119	90 00	139 10	126 82
4	189	136	78 00	112 50	103 86
5	115	107½	66 00	82 60	82 60
6	34	34	54 00	65 07	59 53
7	50	45	42 00	48 36	45 18
8	47	47	18 00	19 04	18 52
9	------------	54	6 00	6 10	6 00

No. 147—UKIAH.

UKIAH MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated May 1, 1894.)

J. M. MANNON, Secretary. W. D. WHITE, President.

Fiscal year ends May 6, 1899.

No. of series, 5. No. of shares, 674¾.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$30,150 00	Installment stock—dues	$30,120 00
Arrearages		503 35	Earnings apportioned	8,626 18
On shares	$134 00		Advance payments	93 60
On interest	201 85		Reserve and undivided profits	25 40
On premiums	151 00		Unearned premiums	385 76
On fines, etc.	16 50			
Cash on hand and in bank		5,978 53		
Real estate owned		2,559 06		
Other assets		60 00		
Total assets		$39,250 94	Total liabilities	$39,250 94

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,305 51	Loans on mortgages and stock	$5,700 00
Installment stock—dues	8,437 00	Dues repaid — installment stock	3,846 50
Interest received	2,316 65	Profits repaid — installment stock	594 80
Premiums received	1,430 45	Salaries	300 00
Fines received	4 80	Taxes	522 66
Fees received	14 20	Other expenses	32 52
Loans repaid	1,250 00	All other disbursements	160 10
All other receipts	376 50	Balance on hand and in bank	5,978 53
Total receipts	$17,135 11	Total disbursements	$17,135 11

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	371½	299½	$60 00	$80 02	$70 50
2	168½	168½	48 00	60 56	54 72
3	46¼	44¼	36 00	42 84	39 24
4	43¼	43¼	24 00	26 92	25 44
5		119¼	12 00	12 71	12 36

No. 148—VENTURA.

VENTURA MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated February 1, 1897.)

CHAS. BARNARD, Secretary. FRED W. BAKER, President.

Fiscal year ends February 28, 1899.

No. of series, 2. No. of shares, 522½.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$11,160 00	Installment stock—dues	$11,184 00
Cash on hand and in bank	1,258 63	Earnings apportioned	1,179 10
Other assets	27 50	Advance payments	1 50
		Reserve and undivided profits	39 88
		Other liabilities	41 65
Total assets	$12,446 13	Total liabilities	$12,446 13

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$399 59	Loans on mortgages and stock	$6,480 00
Installment stock—dues	6,591 50	Dues repaid — installment stock	1,112 00
Interest received	766 78	Profits repaid — installment stock	45 72
Premiums received	254 82	Salaries	120 00
Fines received	11 75	Taxes	76 72
Fees received	32 05	Other expenses	14 92
Loans repaid	1,045 00	Balance on hand and in bank	1,258 63
All other receipts	6 50		
Total receipts	$9,107 99	Total disbursements	$9,107 99

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	475½	409½	$24 00	$26 70	$24 72
2		113	12 00	12 65	12 36

No. 149—VISALIA.

VISALIA BUILDING AND LOAN ASSOCIATION.

(Incorporated January 5, 1887.)

C. L. JOHNSON, Secretary. C. J. GIDDINGS, President.

Fiscal year ends February 11, 1899.

No. of series, 3. No. of shares, 1,410.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$52,200 00	Installment stock—dues	$34,041 00
Arrearages		140 41	Earnings apportioned	7,682 98
On shares	$98 29		Advance payments	38 00
On interest	31 18		Overdrafts and bills payable	6,829 71
On fines, etc.	10 94		Reserve and undivided profits	290 60
Real estate owned		4,966 51	Unearned premiums	8,666 62
Other assets		241 99		
Total assets		$57,548 91	Total liabilities	$57,548 91

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$14,389 22	Overdrafts and bills payable	$10,086 75
Interest received	4,667 23	Loans on mortgages and stock	7,600 00
Premiums received	1,552 30	Interest paid	848 71
Fines received	382 76	Dues repaid — installment stock	20,222 50
Fees received	43 00	Profits repaid—installment stock	10,256 40
Loans repaid	22,900 00	Salaries	480 00
Overdrafts and bills payable	10,362 71	Taxes	920 95
All other receipts	1,373 95	Other expenses	137 95
		All other disbursements	5,117 91
Total receipts	$55,671 17	Total disbursements	$55,671 17

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	184	184	$48 00	$63 51	$59 25
5	525	525	36 00	44 01	41 00
6	608	701	9 00	9 89	9 45

No. 150—WATSONVILLE.

WATSONVILLE MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated April 12, 1897.)

C. A. Palmtag, Secretary. James Waters, President.

Fiscal year ends April 30, 1899.

No. of series, 14. No. of shares, 1,331.

Financial Statement.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$13,675 00	Installment stock—dues	$14,687 00
Arrearages	293 00	Earnings apportioned	1,350 64
On shares $293 00		Advance payments	676 95
Cash on hand and in bank	2,787 51	Reserve and undivided profits	60 92
Other assets	20 00		
Total assets	$16,775 51	Total liabilities	$16,775 51

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$8,935 20	Overdrafts and bills payable	$484 92
Interest received	632 15	Loans on mortgages and stock	6,650 00
Premiums received	754 80	Interest paid	5 55
Fines received	4 20	Dues repaid — installment stock	309 00
Fees received	36 00	Salaries	368 75
Loans repaid	400 00	Taxes	102 47
		Other expenses	54 15
		Balance on hand and in bank	2,787 51
Total receipts	$10,762 35	Total disbursements	$10,762 35

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	740	730	$14 40	$14 98	Dues and such profits as the Directors may determine.
2	100	80	13 80	14 29	
3	5	5	12 60	12 94	
4	31	31	12 00	12 27	
5	20	15	11 40	11 61	
6	5	5	10 20	10 31	
7	50	45	9 00	9 05	
8	110	90	8 40	8 44	
9	10	10	7 80	7 81	
10		5	7 20	7 20	
11		35	6 00	6 00	
12		175	4 20	4 20	
13		35	3 00	3 00	
14		70	1 80	1 80	

No. 151—WOODLAND.

WOODLAND BUILDING AND LOAN ASSOCIATION.

(Incorporated June 8, 1886.)

E. T. CLOWE, Secretary. J. I. MCCONNELL, President.

Fiscal year ends December 30, 1898.

No. of series, 1. No. of shares, 586.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$30,739 27	Installment stock—dues	$42,192 00
Arrearages		4,154 75	Earnings apportioned	5,152 46
On shares	$1,659 00		Reserve and undivided profits	100 46
On interest	2,416 15		Other liabilities	262 57
On fines, etc.	79 60			
Cash on hand and in bank		1,571 36		
Real estate owned		7,599 39		
Other assets		3,642 72		
Total assets		$47,707 49	Total liabilities	$47,707 49

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$9,781 77	Loans on mortgages and stock	$12,857 00
Installment stock—dues	6,719 00	Dues repaid — installment stock	8,590 00
Interest received	1,953 50	Salaries	780 00
Fines received	3 00	Taxes	346 01
Loans repaid	6,439 00	Other expenses	158 55
All other receipts	1,563 65	All other disbursements	2,157 00
		Balance on hand and in bank	1,571 36
Total receipts	$26,459 92	Total disbursements	$26,459 92

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	723	586	$72 00	$80 11	$72 00

REPORT

ON THE

BUILDING AND LOAN ASSOCIATIONS

OF THE

STATE OF CALIFORNIA

BY THE

BOARD OF COMMISSIONERS OF THE BUILDING AND LOAN ASSOCIATIONS,
IN ACCORDANCE WITH AN ACT OF THE LEGISLATURE,
APPROVED MARCH 23, 1893,

TO

His Excellency HENRY T. GAGE, Governor of the State of California.

OCTOBER 1, 1900.

SACRAMENTO:
A. J. JOHNSTON, : : : : : : SUPERINTENDENT STATE PRINTING.
1900.

REPORT.

Office of the Board of Commissioners of the
Building and Loan Associations,
San Francisco, Cal., October 1, 1900.

To His Excellency Henry T. Gage,
Governor of the State of California:

Sir: Pursuant to the requirements of Chapter CLXXXVIII, Statutes of California, we submit herewith the Seventh Annual Report of this office, covering the work of this Board for the fiscal term from June 1, 1899, to May 31, 1900, both inclusive.

This report embraces the compilations and calculations made therefrom of the annual reports of 148 associations in active operation on May 31st last, and which had then been transacting business for more than one year.

The results obtained show a material reduction in the assets and in the percentage and volume of net profits resulting from the business transacted for the fiscal years covered by the reports of the several associations comprising the compilations.

The reduction in assets is equal to 6.65 per cent of the assets for 1899, and in net profits 14.03 per cent in volume, or .52 per cent in rate on the average loans in force.

This reduction in assets is mostly confined to the loans in force. Even though there appears to have been 256 more loans made than during the period covered by the previous report, the number of borrowing members is 119 less than those shown at that date, showing that a much larger number of loans were paid off than were granted and made.

The pro rata of borrowers for the purpose of erecting new dwellings seems to have, nevertheless, been maintained, as the reports show that 37 more loans were granted for this purpose than in the previous year; and the grand total of houses constructed through this medium has now reached an aggregate number of 13,965—a very respectable city in itself, were all concentrated in one locality.

The total roll of all associations has been decreased by two, and the active roll by four, with a prospect of a further reduction by seven at an early date, unless new associations shall be formed to take the places of those retiring, of which there seems to be but little prospect at this

date, as the present indications are unfavorable to the formation of more than one or two at most.

In our last report we spoke of the very unsatisfactory results obtained from the compilations because of the fact that the reports of the associations cover their fiscal years, instead of a specific period, and we desire to renew the recommendation made in that report, that some specific date should be fixed by law on which all associations should make a report to this office, and that such reports should be used in making the compilations for the report required to be made by us in lieu of the annual reports, as now required. Under such conditions the status of all associations could be shown on the date thus fixed, and not have them cover a variety of dates reaching back into the past for four to sixteen months prior to date of publication, during which period great changes may have taken place in many, if not in all, associations in the State.

GENERAL STATUS.

Number of associations reporting in 1899		15
Associations reporting for the first time—		
Los Angeles County Mutual—Pasadena		
Covina Mutual—Covina		3
West Shore Mutual—San Francisco		
		154
Retired—		
Borrowers Mutual—San Francisco	2	
Second Colton—Colton		
In liquidation from active roll—		
San Diego Savings and Loan—San Diego		
Occidental—Sacramento	3	
Homeseekers Loan—San Francisco		
Not reporting	1	
		6
Total reporting in 1900		148
Add—Not reporting	1	
New associations for year—		
Colusa Mutual—Colusa	1	
Resumed business—		
Phenix (formerly Republic)—San Francisco	1	
		3
Total active roll May 31, 1900		151
Liquidating voluntarily—		
Yerba Buena Mutual—San Francisco		
Homeseekers Loan—San Francisco	4	
Occidental—Sacramento		
San Diego Savings—San Diego		
Liquidating by receivers—		
Imperial—Los Angeles	2	
Union—Sacramento		
		6
Total roll June 1, 1900		157

During the past year the Co-op Mutual of San Francisco completed liquidation, paying shareholders upwards of 90 per cent.

Since June 1st we have been advised of the proposed liquidation and retirement of the Mechanics Savings Mutual of Los Angeles, the Savings Fund and Building Society of Los Angeles, the Salinas Mutual of Salinas, the Pacific Mutual of San Francisco, the Security Loan of San Francisco, the Merchants Loan of San Francisco, and the Equity Building and Loan of Oakland; the reports of all of which appear in their proper places herein.

Regarding the Equity of Oakland: At an examination made in February last, it was found that because of a surplus of comparatively unproductive real estate and the gradual withdrawal of members, the association was fast approaching the point where we should be compelled to report it to the Attorney-General. To avoid such a contingency we advised them to cease all new business and take the necessary steps to go into voluntary liquidation at an early date. Our suggestion was acted upon, and on July 2d the shareholders adopted a resolution to that effect.

The one association specified as not reporting has for several months been endeavoring to secure an adjustment of a large shortage of its former Secretary, which adjustment has now been effected in full, but of too late a date to have the report prepared and filed for presentation herein.

ASSOCIATIONS AND ASSETS.

The following table shows the growth of the business since 1872, as to number of associations each year; associations reporting since 1893 and the yearly aggregate of assets and liabilities since that date:

1872	1	association.	1884	16	associations.
1874	2	"	1886	31	"
1875	5	"	1887	44	"
1876	6	"	1888	49	"
1879	7	"	1889	82	"
1881	9	"	1890	105	"
1882	11	"	1891	126	"
1883	14	"	1892	136	"

	Associations.	No. Reporting.	Assets.
1893–4	146	137	$20,820,082 18
1894–5	153	144	21,500,520 01
1895–6	153	147	21,470,309 86
1896–7	155	151	21,791,928 81
1897–8	157	148	20,721,226 72
1898–9	159	151	20,285,454 24
1899–00	157	148	18,935,883 76

DISTRIBUTION BY COUNTIES—ACTIVE ROLL.

The portions of the State partially covered by associations in active existence on June 1st last were:

Alameda	14 associations.	San Diego	3 associations.
Colusa	1 "	San Francisco	68 "
Fresno	1 "	San Luis Obispo	1 "
Humboldt	1 "	San Joaquin	2 "
Kern	2 "	San Mateo	2 "
Los Angeles	21 "	Santa Barbara	1 "
Marin	3 "	Santa Clara	6 "
Merced	1 "	Santa Cruz	1 "
Mendocino	3 "	Solano	1 "
Monterey	1 "	Sonoma	3 "
Napa	1 "	Stanislaus	1 "
Orange	3 "	Tulare	2 "
Placer	1 "	Ventura	2 "
Sacramento	2 "	Yolo	1 "
San Bernardino	2 "		

Total: 29 counties .... 151 associations.

CAPITALIZATION.

Of the 151 associations, as above, 148 reports due during the fiscal year have been tabulated, and from these it appears that the total incorporated capital is $537,100,000, represented by 4,503,500 shares, as follows:

38 associations .... 3,636,000 shares of a par value of $100 each.
110 associations .... 867,500 shares of a par value of $200 each.

Of the shares issued and in force,

38 associations have .... 270,208½ shares of $100 each.
110 associations have .... 144,091 shares of $200 each.

ASSETS AND LIABILITIES.

The gross assets of the 148 associations whose annual terms closed within the fiscal term ended May 31, 1900, amount to $18,935,883 76, showing a loss of $1,349,570 48, or 6.65 per cent, as compared with the reports for 1899, and the details appear to be as follows:

ASSETS.

		Increase.	Decrease.
Loans	$15,404,961 03		$1,334,143 59
Arrearages	405,865 70		115,738 04
Cash in hand	624,393 11	$393 21	
Real estate	2,144,226 42		7,239 77
Other assets	356,437 50	107,157 71	
Totals	$18,935,883 76		$1,349,570 48

LIABILITIES.

		Increase.	Decrease
Installment stock	$11,712,202 14		$1,160,468 56
Paid-up and prepaid stock	1,861,903 58	$342,361 68	
Earnings apportioned	3,530,248 78		522,751 02
Advance payments	79,383 48	3,372 98	
Overdrafts and bills payable	752,272 75		31,886 92
Reserve and undivided profits	421,385 42		18,924 21
Unearned premium	122,430 66		53,518 11
Other liabilities	456,056 95	92,243 68	
Totals	$18,935,883 76		$1,349,570 48

RECEIPTS.

	1899.	1900.
Balance last report	$615,033 53	$627,386 46
Installment stock	3,316,486 34	3,253,291 42
Paid-up and prepaid stock	689,329 21	781,243 61
Interest	1,237,176 49	1,164,405 39
Premium	371,391 38	317,414 33
Fines	30,616 33	22,945 81
Fees	5,957 75	5,933 17
Loans repaid	4,370,166 04	4,718,274 36
Overdrafts and bills payable	887,580 21	853,414 10
Other receipts	824,399 99	800,658 44
Totals	$12,348,137 57	$12,544,967 09

DISBURSEMENTS.

	1899.	1900.
Overdrafts and bills payable	$1,041,411 64	$870,047 65
Loans	3,399,474 39	3,613,237 95
Interest	102,021 70	86,956 78
Dues repaid—installment stock	3,613,026 54	4,024,916 11
Profits repaid	1,196,118 99	1,284,065 63
Paid-up and prepaid stock	411,601 36	517,481 05
Salaries	201,153 72	197,130 60
Taxes	228,200 22	213,327 63
Other expenses	149,530 70	153,125 40
All other payments	1,381,598 41	960,285 18
Balance on hand	623,999 90	624,393 11
Totals	$12,348,137 57	$12,544,967 09

PLANS OF PREMIUM AND DISTRIBUTION OF PROFITS.

During the past year few changes have been made in the premium plans, other than those necessitated by reason of changes made in the working plans of the several associations, notably the changes from the serial to the Dayton plan, wherein few, if any, associations take any note of premium.

The several plans now in use are detailed as follows:

Installment plan	84	associations.
Gross plan	16	"
Gross and Installment plans	26	"
No premium	22	"

The distribution of the earned profits now appears to be embraced in four general rules, viz.: the "Dexter," "Partnership" (including Rice's and Clark's formulas), "Wrigley" and "Third Dividend," as follows:

Dexter Rule	97	associations.
Partnership Rules	36	"
Wrigley Rule	13	"
Third Dividend Rule	2	"

STATISTICAL INFORMATION.

From the tabulation of the reports of the 148 associations we collate the following:

	In 1899.		In 1900.	
Number of members—Male and societies	27,292		27,801	
Female	9,488		9,655	
		36,780		37,456
Number of borrowers		12,488		12,369
Number of mortgage loans for year		2,524		2,697
Number of stock loans for year		1,657		1,750
Number of pieces of property owned				940
Number of houses built from loans—Report of 1897			1,122	
Report of 1898			1,192	
Report of 1899			958	
Report of 1900			995	
Total houses reported built, all associations, since organization				13,965
Shares in force last report, 148 associations				405,933½
Shares issued since last report				131,659¾
Shares withdrawn and matured				123,293¾
Shares in force				414,299½
Shares pledged for loans				111,057
Net profits for year				$1,070,972 83
Real estate owned				2,144,226 42
Appraised value of real estate owned				2,186,500 00
Assessed value of real estate owned				1,337,253 00
Reserve and undivided profits				421,385 42

SHARES MATURED.

DURING THE FISCAL TERM ENDED MAY 31, 1900.

Number of associations maturing shares		48
Number of series matured		69
Number of shares matured		6,343¾
Dues repaid on matured shares		$722,949 00
Profits repaid on matured shares		$422,386 00
Average time of maturity, $200 shares, $1.00 payments	126 months	8.47%
Average time of maturity, $100 shares, .50 payments	126 months	8.47%
Average time of maturity, $200 shares, $1.00 payments	72 months	10.80%
Average time of maturity, $100 shares, .60 payments	104½ months	10.36%

NEW LOANS AND LOANS REPAID.

During the fiscal years represented by the reports of the 148 associations it appears that 2,697 mortgage loans and 1,750 stock loans were made to borrowers, aggregating $3,613,237 95, which is 23.45 per cent of the loans in force.

During the same period $4,718,274 36 in loans were repaid in some form, which sum is 23.18 per cent of all loans that have been in force during the year. As compared with the reports for the past four years the showing is:

	New Loans.	Loans Repaid.
1896	17.66%	18.16%
1897	19.41	16.50
1898	19.97	19.08
1899	20.75	20.71
1900	23.45	23.18

INTEREST AND PREMIUM COLLECTED.

The collections on account of interest were $1,164,405 39, and on account of premium $317,414 33; these are respectively 7.29 per cent and 1.98 per cent of the average loans in force during the year, and compare with the past four years as follows:

	Interest.	Premium.	Total.
1896	6.90%	2.31%	9.21%
1897	6.93	2.30	9.23
1898	6.92	2.26	9.18
1899	7.18	2.15	9.33
1900	7.29	1.98	9.27

NET PROFITS FOR THE YEAR.

As compiled from the reports of the several associations, it appears that the net profits for the past year aggregate $1,070,972 83, which is 6.71 per cent of the average amount of loans in force for the year; this sum is also equal to 6.08 per cent of the average capital, including profits apportioned, and 5.46 per cent of the average total assets for the year.

For the purposes of comparison we append the percentages representing the rate of profits, similarly calculated, on the average loans in force, as per reports of former years:

1894	7.77%	1898	7.28%
1895	7.19	1899	7.23
1896	7.11	1900	6.71
1897	7.20		

SALARIES, TAXES, AND OTHER EXPENSES.

The amount reported as paid out by these associations for salaries, taxes, and other expenses aggregates $563,583 63.

The shares reported as being in force at the close of their respective fiscal years are 414,299, of which 270,208 are of $100 each and the balance are of $200 each. Reducing these to a basis of $100 each, the cost to each share in force would then be:

Salaries	$0 35.30
Taxes	38.20
Other expenses	27.42
Total	$1 00.92

This expense, based on the average loans in force, would make the cost of conducting the business .03.53 per cent; based on the average capital including profits apportioned it would be .03.19 per cent, and based on the average total assets for the year the cost would be .02.87 per cent.

As compared with the figures shown in the reports for the past three years, the showing is:

	Salaries.	Taxes.	Other Expenses.	Total.
1897	$0 34.10	$0 42.30	$0 19.20	$0 95.60
1898	34.80	38.30	22.20	95.30
1899	35.11	39.87	26.07	1 01.05
1900	35.30	38.20	27.42	1 00.92

We have seen that under the head of "Net Profits for the Year" the percentage, based on average loans in force, was for the past year 6.71 per cent, while the expenses, calculated on the same basis, have been 3.53 per cent; it follows then that the net earnings plus the expenses must have been equivalent to 10.24 per cent of the loans.

Were all associations conducted on the local plan, then this 10.24 per cent would represent the gross earnings and the expenses would be 34.47 per cent of the income, but as a portion of the associations are conducted partially on an expense fund basis these figures represent the true gross earnings varied by the expense fund deductions, and the same condition becomes true and more apparent as to the expense fund associations when we come to segregate the reported net profits and expenses of the two classes and make similar calculations for each; the showing then is:

	Net Profits.	Expenses.	Gross.	Expense Per Cent.
Locals	6.10%	2.82%	8.92%	31.62%
Expense Fund Associations	8.58	5.69	14.27	39.87

REAL ESTATE.

The volume of real estate is practically the same as that shown by the reports for 1899, and constitutes the most undesirable feature resulting from the operations of the associations; in much the larger percentage of cases the income barely exceeds the expenses of repairs, insurance, and taxes, and thus the cost on the books practically represents so much dead capital on which the shareholders get no return.

Much of this has been held several years, the directors indulging in the anticipation of an advance in values sufficient to enable them to recover for the members a portion, at least, of the depreciation represented by the reserve created to meet this condition. Thus far the enhancement in values has been slight, and barely offsets the natural deterioration of the improvements. Under such conditions the retention of the property by the associations is of very questionable utility, and where such conditions exist we feel that it would be a wise move to dispose of the property on the best terms obtainable, pocket the loss and charge it off as against the reserve, and thus convert non-income-producing capital into capital that may be in such shape as to warrant the expectation of an adequate return in the shape of interest.

DIFFICULTY IN LOANING.

In many portions of the State the associations have experienced much difficulty in securing acceptable loans, while in a few portions the demand has been good and in some cases exceeded the supply of funds available for loaning purposes. True, this difficulty has existed in a certain degree for several years, mainly caused by local conditions, but at no time has there been such an universal complaint of the scarcity of acceptable loans as during the past year. The cause for this condition has been sought for by secretaries and directors, but so far as we are advised there is a woful lack of unanimity of opinion as to the cause and continuance of the present widespread lack of demand. If it be because of a lack of confidence, it behooves the directors to seek the reasons therefor and proceed to remedy them without delay. If it comes as a natural result of the increased and always uncertain term of maturity, then all unproductive capital should be converted into productive without delay, in an attempt to shorten the term. If it be the result of a larger supply of idle money in the hands of banks and private capitalists seeking avenues of loaning on almost any terms, so long as it is reasonably secure and will earn something over and above taxes, then the question is one of more difficult solution, unless the associations are ready and willing to meet the drop in the loaning rate. If this be done the term of maturity is perforce extended in proportion, resulting in dis-

satisfaction because the shares held fail to mature in the same time on an eight per cent loaning rate that they formerly did on a ten per cent rate. That the supply of idle capital is larger and the rate of interest lower than for some years past, there is scarcely a shadow of doubt: this being the case, associations must lower the rate in common with other sources of supply if they would retain the volume of business shown by their former reports, and investing shareholders must realize that from this time, until a turn in the tide, they must be content with a lower return in the shape of profits on their periodical investments. With a lowering in the rates of loaning, directors must scrutinize the expenses of conducting the business, or strive to enlarge the volume so that the pro-rata percentage of expenses to income shall not be increased and become a cause of further comment and dissatisfaction.

During the past six years there has been a wonderful change in the building and loan business, not alone on this coast but throughout the entire Eastern States; revolution and evolution seem to be the order now; associations in most of the States are seeking revised and improved methods, especially in the manner of making loans. The old Gross Premium plan has been succeeded by the Installment, and now this bids fair to be succeeded by the Definite Contract plan, just as the old Terminating association was succeeded by the Serial and is now fast being succeeded by the Dayton. A definite contract plan of loaning that should be both definite and mutual has been the study and aim of thoughtful building and loan men in all parts of the country. Numerous plans have been devised and tried, some to be continued, others to be abandoned because of various objections. In this State a plan has been devised that differs materially from any of those in use in the East, and which is being fast adopted by the associations as an auxiliary to the present methods; it is definite as to time and more nearly mutual than any that has come to our notice. Time alone can demonstrate its usefulness, but thus far the associations that have adopted it report an increase in their loans as the result of its adoption.

Since the filing of our last annual report it has been found necessary to report two associations to the Attorney-General for violations of law in the conduct of their business. Thus far we have not been advised of any action being instituted by him to prevent a continuance of their business because of such violations, hence we conclude that in the exercise of the discretion granted him by law he has deemed it best that no publicity be given thereto.

In reporting these associations, we have complied with the law as we understand it, and we feel that the circumstances and conditions found to exist fully warranted us in reporting them as we did; and we desire

to say to them and to all, that if, in future examinations, similar conditions be found to exist we shall proceed to relieve ourselves from responsibility for results that may accrue therefrom by at once reporting the facts to the Attorney-General for his consideration.

Some few associations appear to be conducting their business on the mistaken idea that the volume of business transacted, as represented by their receipts and disbursements, is an evidence of prosperity.

Were the net results, as evidenced by their actual net profits to their shareholders, capable of sustaining this idea they would have good reason to be proud. From the standpoint of a shareholder, the association that returns to him his total investment, together with the largest percentage of profit during the term of its investment, is his ideal. The percentage of shares that continue in force to maturity is small as compared with those that are withdrawn prior thereto, hence the only really satisfied shareholder of this class is he who gets a return of all his investment, whenever he may call for it, together with a reasonable profit for the time invested; he who does not get this is dissatisfied, and it makes no difference whether the failure to receive a full return of his capital be caused by losses legitimately incurred, or result from a deduction of a portion thereof for membership fees and expenses. Every dissatisfied shareholder has some friends and a certain amount of influence in his immediate locality, and if he be specially grieved because of the treatment received, he uses that influence adversely to the association, and while the association may seemingly prosper for a time under such conditions, the day will surely come when a continuance of the practice will cause an unpopularity for it and its methods that will have a marked effect, not alone on its business and standing, but upon the business and standing of associations whose methods are not open to the same criticisms and who are undeserving of the censure thus forced upon them.

Complaints based on such dissatisfaction are of almost daily occurrence, and more of the time of this office, during office hours, is occupied in explanation and adjustment thereof than is demanded by any and all other classes of members. True, the associations complained of appear to be working within the provisions of their by-laws; but the fact that the text of those by-laws may not be in violation of statute law is a poor excuse for some of the practices complained of; still, the fact that they appear to be working within the law bars this office from prescribing a drastic treatment, sometimes richly deserved.

Shareholders have a right to expect and demand that every penny paid into the association on account of their installment stock shall be applied in such manner as to mature that stock at the earliest possible date. It requires no argument to demonstrate that a share of stock will mature at an earlier date if the entire periodical payment be

applied to that purpose than if a portion of it be set apart for the purpose of paying the expenses of the association. It is a well-known fact that comparatively few of the members understand the application of the expense fund deductions, or how it affects the maturing of their stock. The remedy for this condition is the passage of a law requiring all expenses to be paid from the earnings alone; laws to this effect have lately been found a necessity in other States, and we earnestly recommend the passage of such an Act at the coming session of the Legislature.

Section 18 of the Act of March 23, 1893, creating this Board and defining its duties and powers, requires all associations to file their annual reports within thirty days after the expiration of their annual fiscal terms, and the blanks furnished for this purpose call special attention thereto. Most associations comply with this provision to the letter, still there are some few secretaries who appear to think that the expiration of the fiscal term means the date of holding their annual meeting rather than the period on which their books are closed for the preparation of their reports; others are somewhat negligent in the preparation and filing of their reports, thus causing an unwarranted delay in the receipt and proper examination by this office. Where such delay occurs with associations whose reports are due at or near the close of the fiscal term for which the tabulations are made by this office, the inconvenience thus caused is much greater than where reports are due at an earlier period. Thirty days after the closing of the books for the preparation of an annual report seems to be ample time within which to prepare and file such report, as it contains very little matter that the shareholders might not reasonably insist on being presented for their consideration at the annual meeting; and we must insist that those secretaries who have heretofore been negligent in this respect, be more prompt in the future and endeavor to have their reports on file in this office within thirty days after the close of their annual fiscal terms.

For courtesies extended and prompt compliance with past suggestions and requirements, we desire to express our due appreciation.

Respectfully submitted.

FRANK H. GOULD,
President,
E. D. McCABE,
Commissioners of the Building and Loan Associations.

J. L. FIELDS,
Secretary.

STATEMENT OF RECEIPTS ON ACCOUNT OF ASSESSMENT FOR EXPENSES

FOR TWELVE MONTHS ENDING MAY 31, 1900.

Name of Association.	Location.	Amount.
Alameda Building and Loan Association	Alameda	$70 20
California Building-Loan Association	Alameda	49 29
Columbian Mutual Building and Loan Association	Alameda	27 14
Encinal Building-Loan Association	Alameda	26 03
Savings, Loan, and Building Association	Anaheim	14 07
Bakersfield Building and Loan Association	Bakersfield	16 25
People's Mutual Building and Loan Association	Bakersfield	16 10
Benicia Building and Loan Association	Benicia	17 60
Homestead Loan Association	Berkeley	101 03
Covina Mutual Building and Loan Association	Covina	10 00
Colusa Mutual Building and Loan Association	Colusa	10 00
Escondido Mutual Building and Loan Association	Escondido	10 00
People's Building and Loan Association	Fort Bragg	10 00
Mutual Building and Loan Association	Fort Bragg	10 00
Fortuna Building and Loan Association	Fortuna	10 00
Mutual Building and Loan Association	Fresno	39 36
Healdsburg Mutual Building and Loan Association	Healdsburg	13 03
California Mutual Building and Loan Association	Los Angeles	10 00
Columbia Loan and Building Association	Los Angeles	33 62
Equitable Loan Society	Los Angeles	41 86
Fraternal Mutual Building and Loan Association	Los Angeles	16 25
Home Investment Building and Loan Association	Los Angeles	32 05
Los Angeles Building and Loan Association	Los Angeles	23 02
Metropolitan Loan Association	Los Angeles	110 30
Savings Fund and Building Society	Los Angeles	25 25
Southern California Loan Association	Los Angeles	126 08
Fidelity Savings and Loan Association	Los Angeles	10 00
State Mutual Building and Loan Association	Los Angeles	299 65
Union Mutual Building and Loan Association	Los Angeles	87 18
Mechanics Savings Mutual Building and Loan Ass'n	Los Angeles	10 12
Provident Mutual Building and Loan Association	Los Angeles	260 00
Protective Savings Mutual Building and Loan Ass'n	Los Angeles	161 54
Borrowers Mutual Building and Loan Association	Los Angeles	11 47
State of California Mutual Building and Loan Ass'n	Los Angeles	20 88
Los Gatos Building and Loan Association	Los Gatos	10 00
Merced Mutual Building and Loan Association	Merced	14 48
Modesto Building and Loan Association	Modesto	10 00
Napa Building and Loan Association	Napa	20 67
Newcastle Building and Loan Association	Newcastle	10 00
Equity Building and Loan Association	Oakland	10 00
Home Security Building and Loan Association	Oakland	80 50
People's Building and Loan Association	Oakland	13 05
Standard Building and Loan Association	Oakland	11 05
Brooklyn Investment and Loan Association	East Oakland	26 44
Cosmopolitan Mutual Building and Loan Association	East Oakland	47 50
Oakland Building and Loan Association	East Oakland	19 21
West Oakland Mutual Loan Association	West Oakland	28 10

STATEMENT OF RECEIPTS—Continued.

Name of Association.	Location.	Amount.
People's Mutual Building and Loan Association	Ontario	$18 25
Orange Building and Loan Association	Orange	22 93
Palo Alto Mutual Building and Loan Association	Palo Alto	14 77
Mutual Building and Loan Association	Pasadena	26 04
Los Angeles County Mutual Building and Loan Ass'n	Pasadena	19 50
Petaluma Mutual Loan Association	Petaluma	16 80
Pleasanton Mutual Building and Loan Association	Pleasanton	10 00
Mutual Building and Loan Association	Pomona	19 97
San Mateo County Mutual Building and Loan Ass'n	Redwood City	63 08
Germania Building and Loan Association	Sacramento	95 10
Sacramento Building and Loan Association	Sacramento	52 83
Salinas Mutual Building and Loan Association	Salinas	10 00
Santa Fe Building and Loan Association	San Bernardino	39 99
San Diego Building and Loan Association	San Diego	126 67
Silver Gate Building and Loan Association	San Diego	16 48
Acme Building and Loan Association	San Francisco	16 50
Ætna Mutual Building and Loan Association	San Francisco	19 71
Alliance Building and Loan Association	San Francisco	14 50
Atlas Building and Loan Association	San Francisco	21 81
Alta Building and Loan Association	San Francisco	10 00
Argonaut Mutual Building and Loan Association	San Francisco	18 96
Bay City Building and Loan Association	San Francisco	20 85
California Mutual S. F. L. and B. Association	San Francisco	19 94
Capital Building and Loan Association	San Francisco	22 83
City Building and Loan Association	San Francisco	22 93
Citizens Building and Loan Association	San Francisco	196 01
Columbia Building and Loan Association	San Francisco	12 17
Commercial Building and Loan Association	San Francisco	33 62
Commonwealth Mutual Building and Loan Association	San Francisco	10 00
Cosmos Loan Association	San Francisco	10 00
Economy Building and Loan Association	San Francisco	18 64
Eintracht Spar und Bau Verein	San Francisco	20 36
El Dorado Loan Association	San Francisco	18 15
Empire Building and Loan Association	San Francisco	28 76
Eureka Loan Association	San Francisco	10 00
Eureka Building and Loan Association	San Francisco	20 57
Excelsior Loan Association	San Francisco	34 68
Fairmount Loan Association	San Francisco	31 66
Fidelity Building and Loan Association	San Francisco	41 91
Franklin Savings and Building Association	San Francisco	39 96
Germania Building and Loan Association	San Francisco	42 46
Golden Gate Mutual Building and Loan Association	San Francisco	10 40
Golden Rule Building and Loan Association	San Francisco	20 98
Golden West Building and Loan Association	San Francisco	11 86
Granite Mutual Building and Loan Association	San Francisco	17 70
Guardian Loan Association	San Francisco	10 00
Home Investment Association	San Francisco	20 54
Home Mutual Building and Loan Association	San Francisco	60 50
Homeseekers Loan Association	San Francisco	10 00
Householders Building and Loan Association	San Francisco	12 33
Humboldt Building and Loan Association	San Francisco	58 19
Inter-Nos Building and Loan Association	San Francisco	45 16
Italian-Swiss Mutual Loan Association	San Francisco	54 15
Mechanics Building and Loan Association	San Francisco	26 96
Merchants Loan Association	San Francisco	10 00
Mission Home and Loan Association	San Francisco	40 64

Statement of Receipts—Continued.

Name of Association.	Location.	Amount.
Monarch Building and Loan Association	San Francisco	$23 19
Mutual Savings Fund Loan and Building Association	San Francisco	54 37
National Home and Loan Association	San Francisco	24 98
Occidental Loan Association	San Francisco	30 81
Pacific Coast Loan Association	San Francisco	23 19
Pacific Loan Association	San Francisco	38 61
Pacific Mutual Building and Loan Association	San Francisco	25 61
Provident Mutual Loan Association	San Francisco	42 74
Prudence Building and Loan Association	San Francisco	24 93
Safety Mutual Building and Loan Association	San Francisco	46 67
San Francisco Mutual Loan Association	San Francisco	29 05
San Francisco and Oakland Mutual Loan Association	San Francisco	63 41
San Francisco Home Mutual Loan Association	San Francisco	24 79
Security Loan Association	San Francisco	10 00
Triumph Loan Association	San Francisco	23 69
Union Loan Association	San Francisco	22 52
Western Loan Association	San Francisco	27 07
Yerba Buena Mutual Building and Loan Association	San Francisco	10 00
California Home Building-Loan Association	San Francisco	10 00
California Guarantee Investment Company	San Francisco	26 96
Continental Building and Loan Association	San Francisco	1,198 88
Pacific Coast Saving Society	San Francisco	231 32
Pacific States Savings, Loan, and Building Company	San Francisco	552 70
Renters Coöperative Investment Company	San Francisco	318 08
Progress Mutual Building and Loan Association	San Francisco	20 88
Richmond Mutual Building and Loan Association	San Francisco	14 64
Globe Mutual Building and Loan Association	San Francisco	35 95
West Shore Mutual Loan Association	San Francisco	10 00
Phœnix Savings, Building, and Loan Association	San Francisco	10 00
Nucleus Building and Loan Association	San José	19 08
Mutual Building and Loan Association	San José	43 10
San José Building and Loan Association	San José	43 29
San Luis Building and Loan Association	San Luis Obispo	39 00
San Mateo Mutual Building and Loan Association	San Mateo	15 63
Marin County Mutual Building and Loan Association	San Rafael	74 77
Home Mutual Building and Loan Association	Santa Ana	43 78
Loan and Building Association	Santa Barbara	71 55
Santa Clara Building and Loan Association	Santa Clara	23 53
Santa Paula Building and Loan Association	Santa Paula	18 07
Santa Rosa Building and Loan Association	Santa Rosa	49 87
Sausalito Mutual Loan Association	Sausalito	10 27
Tamalpais Mutual Building and Loan Association	Sausalito	10 00
San Joaquin Valley Building and Loan Association	Stockton	41 80
Stockton Land, Loan, and Building Association	Stockton	97 55
Tulare Building and Loan Association	Tulare	15 14
Ukiah Mutual Building and Loan Association	Ukiah	13 17
Ventura Mutual Building and Loan Association	Ventura	14 15
Visalia Building and Loan Association	Visalia	17 42
Watsonville Mutual Building and Loan Association	Watsonville	19 13
Woodland Building and Loan Association	Woodland	10 00
Total collections		$7,414 78
Transmitted to State Treasurer		7,414 78

STATE OF CALIFORNIA,
City and County of San Francisco. } ss.

J. L. Fields, being first duly sworn, deposes and says that he is Secretary of the Board of Commissioners of the Buildihg and Loan Associations and that the foregoing statement is correct.

J. L. FIELDS.

Subscribed and sworn to before me this 27th day of September, 1900.

FRANK H. GOULD,
Commissioners of Building and Loan Associations.

REPORTS

OF

Building and Loan Associations.

ALPHABETICALLY ARRANGED BY CITIES AND TOWNS.

REPORTS OF BUILDING AND LOAN ASSOCIATIONS.

No. 1—ALAMEDA.

ALAMEDA BUILDING AND LOAN ASSOCIATION.

(Incorporated March 7, 1876.)

F. H. CLARK, Secretary pro tem. C. C. VOLBERG, President.

Fiscal year ends March 31, 1900.

No. of series, 33. No. of shares, 2,738¾.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$155,990 00	Installment stock—dues	$133,515 00
Arrearages		7,026 60	Earnings apportioned	46,508 00
On shares	$2,615 00		Advance payments	191 00
On interest	3,890 35		Overdrafts and bills payable	14,880 65
On fines, etc.	521 25		Reserve and undivided profits	4,273 66
Cash on hand and in bank		1,747 17	Other liabilities	623 58
Real estate owned		32,663 42		
Other assets		2,564 70		
Total assets		$199,991 89	Total liabilities	$199,991 89

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$33,655 50	Overdrafts and bills payable	$21,748 80
Interest received	18,529 95	Loans on mortgages and stock	46,257 95
Premiums received	119 35	Interest paid	1,187 08
Fines received	262 70	Dues repaid — installment stock	41,913 00
Fees received	17 90	Profits repaid — installment stock	18,045 60
Loans repaid	65,625 00	Salaries	1,200 00
Overdrafts and bills payable	16,418 65	Taxes	1,388 47
All other receipts	8,012 22	Other expenses	1,163 56
		All other disbursements	7,989 64
		Balance on hand and in bank	1,747 17
Total receipts	$142,641 27	Total disbursements	$142,641 27

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
126	$126 00	$198 60	$195 00
120	120 00	190 05	186 55
108	108 00	162 94	160 20
96	96 00	138 05	133 85
84	84 00	115 20	108 96
72	72 00	94 23	87 56
60	60 00	74 98	69 00
48	48 00	57 31	53 80
36	36 00	41 14	39 30
24	24 00	26 10	25 50
12	12 00	12 40	12 40
6	6 00	6 10	6 10

No. 2—ALAMEDA.

CALIFORNIA BUILDING-LOAN ASSOCIATION.

(Incorporated February 9, 1888.)

CHAS. E. NAYLOR, Secretary. F. H. McCORMICK, President.

Fiscal year ends February 28, 1900.

No. of series, 15. No. of shares, 1,866.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$129,250 00	Installment stock—dues	$86,736 00
Arrearages		3,042 45	Earnings apportioned	31,690 80
On shares	$1,147 00		Advance payments	698 00
On interest	1,491 35		Overdrafts and bills payable	24,158 68
On premiums	288 50		Reserve and undivided profits	1,373 87
On fines, etc.	115 60		Unearned premiums	1,306 80
Cash on hand and in bank		1,391 73	Other liabilities	829 84
Real estate owned		7,730 38		
Other assets		5,379 43		
Total assets		$146,793 99	Total liabilities	$146,793 99

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,917 73	Overdrafts and bills payable	$27,611 10
Installment stock—dues	23,396 00	Loans on mortgages and stock	16,770 00
Interest received	12,182 49	Interest paid	1,632 54
Premiums received	1,678 45	Dues repaid — installment stock	36,183 00
Fines received	272 60	Profits repaid — installment stock	18,421 17
Fees received	54 00	Salaries	1,460 00
Loans repaid	38,820 00	Taxes	1,854 74
Overdrafts and bills payable	24,158 68	Other expenses	669 34
All other receipts	5,047 65	All other disbursements	3,533 98
		Balance on hand and in bank	1,391 73
Total receipts	$109,527 60	Total disbursements	$109,527 60

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
3	50	$120 00	$192 00	$192 00
4	231	108 00	166 32	166 32
5	55	96 00	142 08	137 47
6	10	84 00	119 28	112 22
7	140	72 00	97 92	90 14
8	198	60 00	78 00	70 80
9	51	54 00	68 58	61 28
10	149	48 00	59 52	53 76
11	10	42 00	50 82	46 41
12	119	36 00	42 48	39 24
13	12	30 00	34 50	32 25
14	264	24 00	26 88	25 44
15	102	18 00	19 62	18 81
16	286	12 00	12 72	12 36
17	189	6 00	6 18	6 00

No. 3—ALAMEDA.

COLUMBIAN MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated July 18, 1893.)

H. K. STARKWEATHER, Secretary. GEO. A. BORDWELL, President.

Fiscal year ends July 31, 1899.

No. of series, 171. No. of shares, 1,100.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$56,451 88	Installment stock—dues	$47,430 00
Arrearages		743 10	Earnings apportioned	8,577 93
On shares	$142 00		Advance payments	3,095 20
On interest	418 00		Overdrafts and bills payable	982 08
On premiums	166 90		Reserve and undivided profits	473 23
On fines, etc.	16 20			
Cash on hand and in bank		524 47		
Real estate owned		2,333 45		
Other assets		505 54		
Total assets		$60,558 44	Total liabilities	$60,558 44

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$513 97	Loans on mortgages and stock	$19,392 65
Installment stock—dues	14,717 35	Interest paid	40 47
Interest received	3,527 57	Dues repaid — installment stock	6,023 00
Premiums received	1,012 70	Profits repaid — installment stock	1,005 00
Fines received	63 40	Salaries	600 00
Fees received	15 10	Taxes	767 92
Loans repaid	6,729 45	Other expenses	186 98
Overdrafts and bills payable	982 08	All other disbursements	6,779 45
All other receipts	7,758 32	Balance on hand and in bank	524 47
Total receipts	$35,319 94	Total disbursements	$35,319 94

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	180	$72 00	$91 20	$85 44
2	65	66 00	81 48	76 89
3	73	60 00	71 81	69 00
4	127	54 00	63 51	61 29
5	122	48 00	55 11	53 26
6	72	42 00	47 36	46 41
7	102	36 00	39 85	39 24
8	74	30 00	32 61	22 25
9	23	27 00	29 07	28 82
10	14	24 00	25 60	25 44
11	46	21 00	22 21	22 10
12	36	18 00	18 87	18 81
13	42	15 00	15 60	15 56
14	39	12 00	12 38	12 36
15	27	9 00	9 22	9 00
16	28	6 00	6 10	6 00
17	30	3 00	3 03	3 00

No. 4—ALAMEDA.

ENCINAL BUILDING-LOAN ASSOCIATION.

(Incorporated December 28, 1889.)

E. MINOR SMITH, Secretary. JOSEPH F. FORDERER, President.

Fiscal year ends December 31, 1899.

No. of series, 21. No. of shares, 1,001.

FINANCIAL STATEMENT.

Assets			*Liabilities.*	
Loans on mortgages and stock		$60,686 73	Installment stock—dues	$60,228 00
Arrearages		2,163 03	Earnings apportioned	18,970 52
On shares	$817 00		Advance payments	1,055 80
On interest	976 66		Overdrafts and bills payable	4,100 00
On premiums	369 37		Reserve and undivided profits	2,837 04
Cash on hand and in bank		1,213 51	Unearned premiums	144 00
Real estate owned		23,016 85		
Other assets		255 24		
Total assets		$87,335 36	Total liabilities	$87,335 36

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$939 78	Overdrafts and bills payable	$100 00
Installment stock—dues	15,802 00	Loans on mortgages and stock	12,990 00
Interest received	7,884 02	Interest paid	332 70
Premiums received	2,441 71	Dues repaid—installment stock	35,454 00
Fines received	234 60	Profits repaid—installment stock	15,067 65
Fees received	21 10	Salaries	936 00
Loans repaid	45,895 00	Taxes	1,318 21
All other receipts	3,350 15	Other expenses	402 35
		All other disbursements	8,753 94
		Balance on hand and in bank	1,213 51
Total receipts	$76,568 36	Total disbursements	$76,568 36

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
120	$120 00	$184 67	$182 67
108	108 00	156 75	152 75
96	96 00	131 89	119 28
84	84 00	109 73	101 85
72	72 00	89 84	85 14
60	60 00	71 88	69 15
48	48 00	55 32	53 88
36	36 00	40 00	39 33
24	24 00	25 72	25 50
12	12 00	12 44	12 39

No. 5—ANAHEIM.

SAVINGS, LOAN, AND BUILDING ASSOCIATION.

(Incorporated January 8, 1889.)

FRED A. BACKS, JR., Secretary. H. A. McWILLIAMS, President.

Fiscal year ends April 30, 1900.

No. of series, 11. No. of shares, 1,082.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$35,709 84	Installment stock—dues	$33,204 00
Arrearages		1,301 10	Earnings apportioned	11,418 43
On shares	$500 75		Advance payments	35 20
On interest	686 74		Reserve and undivided profits	509 23
On fines, etc.	113 61			
Cash on hand and in bank		8,155 92		
Total assets		$45,166 86	Total liabilities	$45,166 86

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$8,179 67	Loans on mortgages and stock	$8,300 00
Installment stock—dues	6,495 50	Dues repaid — installment stock	2,743 00
Interest received	2,537 55	Profits repaid — installment stock	1,150 93
Premiums received	526 20	Salaries	185 35
Fines received	81 75	Other expenses	101 97
Fees received	10 50	Balance on hand and in bank	8,155 92
Loans repaid	2,800 00		
All other receipts	6 00		
Total receipts	$20,637 17	Total disbursements	$20,637 17

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	98	$66 00	$105 71	$105 71
2	27	60 00	91 80	91 80
3	55	54 00	77 97	77 97
4	58	48 00	66 26	66 26
5	111	42 00	55 52	55 52
6	130	36 00	45 62	45 62
7	102	30 00	36 55	36 55
8	106	24 00	28 16	28 16
9	127	18 00	20 32	20 32
10	87	12 00	13 02	13 02
11	181	6 00	6 26	6 26

No. 6—BAKERSFIELD.

BAKERSFIELD BUILDING AND LOAN ASSOCIATION.

(Incorporated May 14, 1890.)

GEO. W. PRICE, Secretary. A. WEILL, President.

Fiscal year ends May 31, 1900.

No. of series, 9. No. of shares, 622.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$84,600 00	Installment stock—dues	$49,284 00
Arrearages		3,344 03	Earnings apportioned	28,341 49
On shares	$1,161 00		Overdrafts and bills payable	29,000 00
On interest	1,709 25		Reserve and undivided profits	2,552 26
On fines, etc.	473 78		Unearned premiums	1,099 57
Cash on hand and in bank		4,899 98		
Real estate owned		17,079 98		
Other assets		353 33		
Total assets		$110,277 32	Total liabilities	$110,277 32

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$10,101 15	Overdrafts and bills payable	$28,000 00
Installment stock—dues	8,571 00	Loans on mortgages and stock	2,250 00
Interest received	9,628 25	Interest paid	2,027 29
Premiums received	17 26	Dues repaid — installment stock	52,946 00
Fines received	425 54	Profits repaid — installment stock	41,609 00
Fees received	2 40	Salaries	600 00
Loans repaid	63,000 00	Taxes	1,244 36
Overdrafts and bills payable	35,000 00	Other expenses	211 71
All other receipts	12,003 08	All other disbursements	4,960 34
		Balance on hand and in bank	4,899 98
Total receipts	$138,748 68	Total disbursements	$138,748 68

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	162	$108 00	$191 07	$188 00
3	116	96 00	154 31	146 00
4	98	84 00	125 06	120 00
5	54	72 00	100 58	92 00
6	98	60 00	80 08	73 00
7	16	48 00	61 02	55 00
8	13	36 00	44 12	39 00
9	53	24 00	28 91	25 00
10	12	12 00	12 79	12 50

No. 7—BAKERSFIELD.

PEOPLE'S MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated January 27, 1892.)

F. W. Robinson, Secretary. Frank S. Rice, Vice-President.

Fiscal year ends January 20, 1900.

No. of series, 7. No. of shares, 1,242½.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$45,275 00	Installment stock—dues	$26,532 00
Arrearages		329 99	Earnings apportioned	10,447 18
On shares	$112 20		Advance payments	180 00
On interest	84 25		Overdrafts and bills payable	7,688 79
On premiums	64 60		Reserve and undivided profits	1,003 41
On fines, etc.	68 94		Other liabilities	178 61
Real estate owned		400 00		
Other assets		25 00		
Total assets		$46,029 99	Total liabilities	$46,029 99

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$11,034 60	Overdrafts and bills payable	$4,185 68
Interest received	3,222 91	Loans on mortgages and stock	16,725 00
Premiums received	3,000 92	Interest paid	117 50
Fines received	62 33	Dues repaid — installment stock	28,356 60
Fees received	82 90	Profits repaid—installment stock	17,841 70
Loans repaid	41,140 00	Salaries	720 00
Overdrafts and bills payable	10,188 79	Taxes	609 06
All other receipts	104 95	Other expenses	204 48
		All other disbursements	77 38
Total receipts	$68,837 40	Total disbursements	$68,837 40

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	128	$50 40	$86 28	$85 50
3	23	43 20	68 01	63 50
4	99	36 00	52 20	47 00
5	267	28 80	38 45	34 30
6	120	21 60	26 58	24 50
7	122½	14 40	16 48	15 50
8	483	7 20	7 72	7 45

No. 8—BENICIA.

BENICIA BUILDING AND LOAN ASSOCIATION.

Incorporated January 11, 1883.

A. Robinson, Secretary. Charles Stewart, President.

Fiscal year ends January 31, 1900.

No. of series, 12. No. of shares, 670.

Financial Statement.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$40,480 00	Installment stock—dues	$20,754 00
Arrearages	1,176 55	Earnings apportioned	4,021 47
On shares $917 00		Advance payments	316 00
On interest 259 55		Overdrafts and bills payable	10,639 72
Other assets	303 07	Reserve and undivided profits	1 45
		Unearned premiums	6,216 04
		Other liabilities	10 94
Total assets	$41,959 62	Total liabilities	$41,959 62

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$7,526 00	Overdrafts and bills payable	$3,049 30
Interest received	2,438 75	Loans on mortgages and stock	13,000 00
Premiums received	2,600 00	Interest paid	776 25
Fines received	32 35	Dues repaid — installment stock	5,579 00
Fees received	18 10	Profits repaid — installment stock	1,991 38
Loans repaid	9,250 00	Salaries	720 00
Overdrafts and bills payable	4,349 35	Taxes	554 30
All other receipts	146 11	Other expenses	91 17
		All other disbursements	599 26
Total receipts	$26,360 66	Total disbursements	$26,360 66

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
7	23	$132 00	$197 22	$193 96
9	12	108 00	147 36	145 40
10	15	96 00	127 00	123 90
11	20	60 00	71 22	66 17
12	52	48 00	55 33	50 93
13	66	42 00	47 56	43 94
14	18	36 00	40 07	37 20
15	48	30 00	32 92	30 73
16	134	24 00	25 90	24 38
17	81	18 00	19 07	18 00
18	91	12 00	12 48	12 00
19	110	6 00	6 12	6 00

No. 9—BERKELEY.

HOMESTEAD LOAN ASSOCIATION.

(Incorporated March 3, 1886.)

F. H. CLARK, Secretary. M. M. ROHRER, President.

Fiscal year ends March 31, 1900.

No. of series, 29. No. of shares, 3,973.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$187,295 00	Installment stock—dues	$174,208 00
Arrearages		3,928 10	Earnings apportioned	57,127 29
On shares	$1,467 00		Advance payments	269 00
On interest	2,113 70		Reserve and undivided profits	2,359 98
On premiums	186 20		Other liabilities	1,305 55
On fines, etc.	161 20			
Cash on hand and in bank		18,414 34		
Real estate owned		11,862 02		
Other assets		13,770 36		
Total assets		$235,269 82	Total liabilities	$235,269 82

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,220 22	Loans on mortgages and stock	$49,519 00
Installment stock—dues	46,797 00	Interest paid	73 01
Interest received	21,637 36	Dues repaid — installment stock	41,641 00
Fines received	162 40	Profits repaid — installment stock	17,672 06
Fees received	46 35	Salaries	1,800 00
Loans repaid	58,892 50	Taxes	3,085 30
All other receipts	20,780 49	Other expenses	604 25
		All other disbursements	18,727 36
		Balance on hand and in bank	18,414 34
Total receipts	$151,536 32	Total disbursements	$151,536 32

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
120	$120 00	$197 93	$194 02
108	108 00	168 42	164 19
96	96 00	141 65	137 54
84	84 00	117 39	113 71
72	72 00	95 37	92 33
60	60 00	75 40	73 09
48	48 00	57 29	55 43
36	36 00	40 85	39 40
24	24 00	25 98	25 14
12	12 00	12 48	12 24

No. 10—COVINA.

COVINA MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated February 11, 1899.)

F. D. McCord, Secretary. F. M. Douglass, President.

Fiscal year ends March 1, 1900.

No. of series, 2. No. of shares, 548.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$7,600 00	Installment stock—dues	$3,108 00
Other assets	147 97	Earnings apportioned	209 80
		Advance payments	5 00
		Overdrafts and bills payable	4,075 17
		Other liabilities	350 00
Total assets	$7,747 97	Total liabilities	$7,747 97

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$3,154 00	Overdrafts and bills payable	$2,000 00
Interest received	284 46	Loans on mortgages and stock	7,250 00
Premiums received	227 90	Interest paid	187 25
Fines received	2 15	Dues repaid — installment stock	41 00
Fees received	59 60	Salaries	90 00
Overdrafts and bills payable	6,075 17	Other expenses	235 03
Total receipts	$9,803 28	Total disbursements	$9,803 28

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	503	$6 00	$6 40	$6 19
2	45	2 00	2 13	2 02

No. 11—ESCONDIDO.

ESCONDIDO MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated September 19, 1893.)

S. L. Shotwell, Secretary. W. H. Baldridge, President.

Fiscal year ends September 30, 1899.

No. of series, 10. No. of shares, 281.

Financial Statement.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$10,200 00	Installment stock—dues	$9,006 00
Cash on hand and in bank	1,222 03	Earnings apportioned	2,472 77
Other assets	80 00	Advance payments	10 85
		Reserve and undivided profits	17
		Other liabilities	12 24
Total assets	$11,502 03	Total liabilities	$11,502 03

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,798 59	Overdrafts and bills payable	$1,150 00
Installment stock—dues	3,492 00	Loans on mortgages and stock	3,220 00
Interest received	881 92	Interest paid	4 57
Premiums received	585 13	Dues repaid — installment stock	3,686 00
Fines received	16 80	Profits repaid — installment stock	1,156 03
Fees received	90	Paid-up and prepaid stock	200 00
Loans repaid	3,120 00	Salaries	144 00
Overdrafts and bills payable	1,150 00	Taxes	267 66
All other receipts	31 10	Other expenses	26 15
		Balance on hand and in bank	1,222 03
Total receipts	$11,076 44	Total disbursements	$11,076 44

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	25	$66 00	$95 09	$87 82
3	25	60 00	83 09	78 32
4	15	54 00	72 46	67 85
5	17	48 00	62 24	58 68
6	12	42 00	52 52	49 89
7	36	36 00	43 31	41 49
8	21	30 00	34 72	33 54
9	45	24 00	26 85	26 13
11	35	12 00	12 64	12 33
12	50	6 00	6 14	6 00

No. 12—FORT BRAGG.

PEOPLE'S BUILDING AND LOAN ASSOCIATION.

(Incorporated October 14, 1889.)

JNO. E. WELLER, Secretary. ERI HUGGINS, President.

Fiscal year ends October 31, 1899.

No. of series, 7. No. of shares, 358½.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$48,300 00	Installment stock—dues	$27,462 00
Arrearages	311 20	Earnings apportioned	17,407 43
On shares $162 00		Advance payments	102 00
On interest 149 20		Reserve and undivided profits	6 61
Cash on hand and in bank	626 59	Unearned premiums	3,096 85
Real estate owned	4,891 42	Other liabilities	7,676 61
Other assets	1,622 29		
Total assets	$55,751 50	Total liabilities	$55,751 50

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$474 25	Loans on mortgages and stock	$3,800 00
Installment stock—dues	4,499 00	Dues repaid — installment stock	420 50
Interest received	2,741 95	Profits repaid — installment stock	151 83
Premiums received	812 50	Salaries	300 00
Fines received	27 60	Taxes	497 47
Fees received	14 05	Other expenses	114 46
Loans repaid	1,100 00	All other disbursements	9,942 69
All other receipts	6,184 19	Balance on hand and in bank	626 59
Total receipts	$15,853 54	Total disbursements	$15,853 54

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	145	$108 00	$191 25	$149 16
3	43	96 00	154 51	127 92
4	61	84 00	123 70	107 88
5	10	72 00	97 48	89 04
8	12	36 00	40 44	39 72
9	29	24 00	26 01	25 56
10	58½	12 00	12 55	12 36

No. 13—FORT BRAGG.

MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated February 7, 1894.)

C. W. MATHEWS, Secretary. MAURICE CAREY, Vice-President.

Fiscal year ends January 31, 1900.

No. of series, 8. No. of shares, 77.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$8,200 00	Installment stock—dues	$4,908 00
Arrearages		396 00	Earnings apportioned	2,261 03
On shares	$257 00		Advance payments	42 80
On interest	138 50		Reserve and undivided profits	19
Cash on hand and in bank		212 13	Unearned premiums	1,914 01
Real estate owned		489 00	Other liabilities	223 40
Other assets		52 30		
Total assets		$9,349 43	Total liabilities	$9,349 43

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$87 57	Loans on mortgages and stock	$500 00
Installment stock—dues	913 00	Dues repaid — installment stock	420 00
Interest received	564 25	Profits repaid—installment stock	178 44
Premiums received	125 00	Salaries	120 00
Fines received	10 80	Taxes	92 15
Fees received	45	Other expenses	16 70
Loans repaid	800 00	All other disbursements	2,802 23
All other receipts	1,840 58	Balance on hand and in bank	212 13
Total receipts	$4,341 65	Total disbursements	$4,341 65

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	53	$72 00	$108 35	$89 64
2	7	66 00	93 94	71 40
4	5	54 00	70 13	54 96
5	5	48 00	58 97	47 34
9	3	24 00	24 90	25 56
10	1	18 00	18 52	18 96
11	2	12 00	12 07	12 36
12	1	6 00	6 04	6 18

No. 14—FORTUNA.

FORTUNA BUILDING AND LOAN ASSOCIATION.

Incorporated April 30, 1889.

CHARLES A. FRIEDENBACH, Secretary. W. P. MCINTYRE, President.

Fiscal year ends May 31, 1900.

No. of series, 12. No. of shares, 302.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$15,010 00	Installment stock—dues	$10,422 00
Cash on hand and in bank	191 36	Earnings apportioned	1,843 12
		Advance payments	65 50
		Overdrafts and bills payable	400 00
		Reserve and undivided profits	69
		Other liabilities	2,470 05
Total assets	$15,201 36	Total liabilities	$15,201 36

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$823 71	Loans on mortgages and stock	$4,180 00
Installment stock—dues	4,051 50	Interest paid	135 50
Interest received	1,052 65	Dues repaid — installment stock	2,709 00
Premiums received	89 35	Profits repaid — installment stock	889 58
Fines received	83 40	Salaries	120 00
Fees received	11 20	Taxes	149 42
Loans repaid	2,280 00	Other expenses	46 90
Overdrafts and bills payable	1,015 00	All other disbursements	1,016 20
All other receipts	31 15	Balance on hand and in bank	191 36
Total receipts	$9,437 96	Total disbursements	$9,437 96

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
10	15	$72 00	$95 96	$92 96
11	15	66 00	85 79	83 31
12	7	60 00	75 66	71 75
13	39	54 00	65 84	62 88
14	17	48 00	56 30	53 20
15	31	42 00	48 14	45 83
16	18	36 00	40 30	38 15
17	41	30 00	32 79	31 40
18	32	24 00	25 64	24 61
19	32	18 00	18 86	18 32
20	26	12 00	12 36	12 20
21	29	6 00	6 10	6 10

No. 15—FRESNO.

MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated March 17, 1892.)

A. V. LISENBY, Secretary. ALEX. GORDON, President.

Fiscal year ends March 1, 1900.

No. of series, 16. No. of shares, 1,495½.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$130,050 00	Installment stock—dues	$99,015 50
Arrearages	811 50	Earnings apportioned	40,860 04
On shares $327 00		Reserve and undivided profits	3,463 73
On interest 484 50		Other liabilities	545 19
Cash on hand and in bank	8,899 33		
Real estate owned	3,893 63		
Other assets	230 00		
Total assets	$143,884 46	Total liabilities	$143,884 46

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$9,120 09	Overdrafts and bills payable	$5,000 00
Installment stock—dues	18,270 00	Loans on mortgages and stock	22,350 00
Interest received	11,071 64	Interest paid	66 35
Premiums received	1,182 00	Dues repaid — installment stock	18,684 50
Fines received	65 80	Profits repaid — installment stock	6,811 93
Fees received	1 50	Salaries	845 00
Loans repaid	19,470 00	Taxes	2,149 87
Overdrafts and bills payable	5,000 00	Other expenses	349 45
All other receipts	2,038 10	All other disbursements	1,062 70
		Balance on hand and in bank	8,899 33
Total receipts	$66,219 13	Total disbursements	$66,219 13

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	610	$96 00	$144 56	$140 00
2	57	90 00	132 66	126 00
3	109	84 00	118 32	112 00
4	15	76 00	102 43	94 50
5	44	72 00	94 77	88 50
6	60½	67 00	85 60	78 00
7	46	60 00	74 14	69 50
8	42	53 00	63 55	60 50
9	46	48 00	56 69	53 75
10	38	42 00	47 87	45 00
11	82	36 00	40 63	38 25
12	83	30 00	32 96	31 00
13	61	24 00	25 85	24 50
14	41	18 00	19 05	18 25
15	68	12 00	12 48	12 00
16	93	6 00	6 13	6 00

No. 16—HEALDSBURG.

HEALDSBURG MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated December 31, 1894.)

J. R. Miller, Secretary. John Favour, President.

Fiscal year ends December 31, 1899.

No. of series, 10. No. of shares, 1,001.

Financial Statement.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$34,750 00	Installment stock—dues	$25,023 00
Other assets	64 00	Earnings apportioned	6,095 96
		Advance payments	74 90
		Overdrafts and bills payable	3,415 58
		Reserve and undivided profits	26
		Other liabilities	204 30
Total assets	$34,814 00	Total liabilities	$34,814 00

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$264 19	Overdrafts and bills payable	$1,830 00
Installment stock—dues	5,896 00	Loans on mortgages and stock	9,550 00
Interest received	1,736 00	Interest paid	90 80
Premiums received	1,388 80	Dues repaid — installment stock	450 00
Fees received	6 70	Profits repaid — installment stock	58 05
Overdrafts and bills payable	3,415 58	Salaries	180 00
		Taxes	491 17
		Other expenses	57 25
Total receipts	$12,707 27	Total disbursements	$12,707 27

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	611	$30 00	$37 98	$35 89
2	103	27 00	33 38	31 79
3	57	24 00	28 82	27 62
4	19	21 00	24 62	23 72
5	40	18 00	20 60	19 30
6	23	15 00	16 79	15 90
7	31	12 00	13 14	12 34
8	50	9 00	9 62	9 19
9	19	6 00	6 27	6 00
10	48	3 00	3 06	3 00

No. 17—LOS ANGELES.

CALIFORNIA MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated August 11, 1891.)

FRED A. WALTON, Secretary. A. C. JONES, President.

Fiscal year ends August 17, 1899.

No. of series, 6. No. of shares, 306.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$29,575 00	Installment stock—dues	$26,512 00
Arrearages		3,764 27	Earnings apportioned	8,740 85
On shares	$1,564 00		Reserve and undivided profits	2,200 27
On interest	2,023 50		Other liabilities	80
On fines, etc.	176 77			
Cash on hand and in bank		1,484 50		
Real estate owned		2,568 15		
Other assets		62 00		
Total assets		$37,453 92	Total liabilities	$37,453 92

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,336 76	Loans on mortgages and stock	$450 00
Installment stock—dues	3,471 00	Interest paid	3 60
Interest received	2,068 60	Dues repaid — installment stock	5,536 00
Fines received	40 50	Profits repaid — installment stock	742 27
Loans repaid	2,766 66	Salaries	900 00
All other receipts	86 80	Taxes	277 96
		Other expenses	35 90
		All other disbursements	340 09
		Balance on hand and in bank	1,484 50
Total receipts	$9,770 32	Total disbursements	$9,770 32

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	151	$96 00	$128 86	$119 00
2	78	93 00	124 50	113 47
3	31	76 00	99 61	90 16
4	15	66 00	85 02	75 51
5	28	48 00	58 72	52 28
6	3	24 00	25 43	24 43

No. 18—LOS ANGELES.

COLUMBIA LOAN AND BUILDING ASSOCIATION.

(Incorporated February 14, 1887.)

LEWIS THORNE, Secretary. A. M. EDELMAN, President.

Fiscal year ends January 31, 1900.

No. of series, 14. No. of shares, 1,160.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$62,500 00	Installment stock—dues	$40,878 00
Arrearages		995 09	Earnings apportioned	19,177 84
On shares	$169 00		Advance payments	577 94
On interest	178 00		Overdrafts and bills payable	7 35
On premiums	70 00		Reserve and undivided profits	1,980 56
On fines, etc.	578 09		Unearned premiums	2,373 40
Real estate owned		1,200 00		
Other assets		300 00		
Total assets		$64,995 09	Total liabilities	$64,995 09

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$528 89	Loans on mortgages and stock	$4,450 00
Installment stock—dues	17,131 00	Dues repaid — installment stock	40,375 00
Interest received	6,141 50	Profits repaid — installment stock	24,160 00
Premiums received	641 25	Salaries	600 00
Fines received	705 38	Taxes	1,800 09
Fees received	44 00	Other expenses	339 76
Loans repaid	46,400 00	All other disbursements	538 77
Overdrafts and bills payable	7 35		
All other receipts	664 25		
Total receipts	$72,263 62	Total disbursements	$72,263 62

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	63	$96 00	$186 02	$122 88
5	41	90 00	166 44	113 62
6	25	84 00	148 19	104 58
9	6	66 00	101 35	78 80
10	77	60 00	88 82	70 50
11	50	54 00	76 95	62 50
12	81	48 00	65 92	54 72
13	19	42 00	55 57	47 14
14	194	36 00	46 01	39 24
15	93	30 00	37 01	32 25
16	96	24 00	28 53	25 20
17	35	18 00	20 84	18 67
18	275	12 00	13 16	12 30
19	105	6 00	6 31	6 00

No. 19—LOS ANGELES.

BORROWERS MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated August 30, 1897.)

WILLIAM MEAD, Secretary. R. M. BAKER, President.

Fiscal year ends September 30, 1899.

No. of series, none. No. of shares, 777.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$40,900 00	Installment stock—dues	$1,779 45
Arrearages		362 85	Paid-up and prepaid stock	36,700 00
On interest	$362 85		Earnings apportioned	879 40
Cash on hand and in bank		395 50	Reserve and undivided profits	822 60
Other assets		41 10	Other liabilities	1,518 00
Total assets		$41,699 45	Total liabilities	$41,699 45

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$31 55	Overdrafts and bills payable	$6,800 00
Installment stock—dues	841 15	Loans on mortgages and stock	12,232 00
Paid-up and prepaid stock	15,500 00	Interest paid	41 15
Interest received	3,314 80	Dues repaid—installment stock	606 00
Loans repaid	3,900 00	Profits repaid—installment stock	15 80
Overdrafts and bills payable	800 00	Paid-up and prepaid stock	1,500 00
All other receipts	19 30	Taxes	360 80
		Other expenses	48 25
		All other disbursements	2,407 30
		Balance on hand and in bank	395 50
Total receipts	$24,406 80	Total disbursements	$24,406 80

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Series.	Book Value per Series.
----------	538	777	$1,779 45	$2,658 85

Dayton plan.

No. 20—LOS ANGELES.

EQUITABLE LOAN SOCIETY.

(Incorporated July 19, 1889.)

W. J. WASHBURN, Secretary. J. A. MUIR, President.

Fiscal year ends December 31, 1899.

No. of series, none. No. of shares, 3,219.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$158,900 00	Installment stock—dues	$33,577 02
Cash on hand and in bank	4,811 28	Paid-up and prepaid stock	122,600 00
		Earnings apportioned	4,141 14
		Reserve and undivided profits	3,393 12
Total assets	$163,711 28	Total liabilities	$163,711 28

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$4,141 81	Loans on mortgages and stock	$62,889 57
Installment stock—dues	49,521 09	Dues repaid — installment stock	44,442 00
Paid-up and prepaid stock	51,900 00	Profits repaid	9,748 54
Interest received	14,152 97	Paid-up and prepaid stock	29,200 00
Loans repaid	36,484 43	Salaries	1,101 00
		Taxes	2,303 98
		Other expenses	1,703 93
		Balance on hand and in bank	4,811 28
Total receipts	$156,200 30	Total disbursements	$156,200 30

DIVIDENDS CREDITED TO STOCK PAYMENTS.

1894	8	per cent semi-annually.
1895	8¼	per cent semi-annually.
1896	8½	per cent semi-annually.
1897	8	per cent semi-annually.
1898	8	per cent semi-annually.
1899, June 30th	7	per cent.
1899, December 31st	6	per cent.

No. 21—LOS ANGELES.

FRATERNAL MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated April 17, 1895.)

H. J. GOUDGE, Secretary. WILLIAM MEEK, President.

Fiscal year ends May 14, 1900.

No. of series, 16. No. of shares, 1,170.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$21,975 00	Installment stock—dues	$19,675 50
Arrearages		205 90	Earnings apportioned	3,921 21
On shares	$131 50		Advance payments	22 00
On interest	57 10		Reserve and undivided profits	72 56
On premiums	14 60			
On fines, etc.	2 70			
Cash on hand and in bank		1,383 12		
Other assets		127 25		
Total assets		$23,691 27	Total liabilities	$23,691 27

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$369 17	Loans on mortgages and stock	$6,415 00
Installment stock—dues	7,471 00	Interest paid	94 76
Interest received	1,926 60	Dues repaid — installment stock	2,785 00
Premiums received	502 60	Profits repaid — installment stock	182 35
Fines received	7 10	Salaries	275 00
Fees received	7 40	Taxes	327 31
Loans repaid	2,640 00	Other expenses	150 43
All other receipts	261 90	All other disbursements	1,572 80
		Balance on hand and in bank	1,383 12
Total receipts	$13,185 77	Total disbursements	$13,185 77

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
60	$30 00	$37 99	$36 00
48	24 00	29 13	27 42
36	18 00	20 85	19 90
24	12 00	13 22	12 61
12	6 00	6 29	6 14
6	3 00	3 08	3 04

No. 22—LOS ANGELES.

FIDELITY SAVINGS AND LOAN ASSOCIATION.

(Incorporated January 23, 1891.)

G. H. WADLEIGH, Secretary. C. C. BOYNTON, President.

Fiscal year ends December 31, 1899.

No. of series, none. No. of shares, 535.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$16,535 00	Installment stock—dues	$9,583 35
Cash on hand and in bank	672 31	Paid-up and prepaid stock	2,800 00
Other assets	683 33	Earnings apportioned	1,831 47
		Overdrafts and bills payable	2,600 00
		Reserve and undivided profits	891 73
		Other liabilities	184 09
Total assets	$17,890 64	Total liabilities	$17,890 64

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,170 51	Overdrafts and bills payable	$13,900 00
Installment stock—dues	5,957 75	Loans on mortgages and stock	2,020 00
Paid-up and prepaid stock	2,600 00	Interest paid	556 73
Interest received	1,041 72	Dues repaid — installment stock	4,495 62
Premiums received	1,242 78	Profits repaid — installment stock	332 06
Fines received	42 00	Paid-up and prepaid stock, and profits	4,684 74
Fees received	10 00	Taxes	260 68
Loans repaid	9,405 10	Other expenses	768 26
Overdrafts and bills payable	5,600 00	All other disbursements	51 30
All other receipts	671 84	Balance on hand and in bank	672 31
Total receipts	$27,741 70	Total disbursements	$27,741 70

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

	Shares Now in Force.	Total Dues per Series.	Book Value per Series.	Withdrawal Value.
$1 payments	225	$4,468 95	$4,826 56	$4,826 56
70c payments	35	143 50	146 91	146 91
60c payments	245	4,986 90	6,431 76	6,431 76
40c payments	10	16 00	16 00	16 00
Prepaid	4	200 00	225 59	225 59
Full paid	26	2,600 00	2,648 68	2,648 68

No. 23—LOS ANGELES.

HOME INVESTMENT BUILDING AND LOAN ASSOCIATION.

(Incorporated August 19, 1889.)

W. A. BONYNGE, Secretary. I. B. NEWTON, President.

Fiscal year ends September 30, 1899.

No. of series, 18. No. of shares, 1,525½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$118,870 00	Installment stock—dues	$89,112 00
Arrearages		2,929 45	Earnings apportioned	45,679 38
On shares	$881 00		Advance payments	1,596 00
On interest	2,048 45		Reserve and undivided profits	68 32
Cash on hand and in bank		6,216 39		
Real estate owned		8,109 18		
Other assets		330 68		
Total assets		$136,455 70	Total liabilities	$136,455 70

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$757 30	Overdrafts and bills payable	$20,635 95
Installment stock—dues	18,628 00	Loans on mortgages and stock	12,630 00
Interest received	10,671 82	Interest paid	551 12
Premiums received	620 00	Dues repaid — installment stock	17,718 00
Fines received	69 75	Profits repaid — installment stock	10,853 06
Fees received	25 50	Salaries	1,810 00
Loans repaid	31,950 00	Taxes	1,585 76
Overdrafts and bills payable	13,000 00	Other expenses	310 28
All other receipts	1,023 12	All other disbursements	4,434 93
		Balance on hand and in bank	6,216 39
Total receipts	$76,745 49	Total disbursements	$76,745 49

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
108	$108 00	$198 34	$193 82
96	96 00	162 99	159 64
84	84 00	133 21	130 75
72	72 00	110 31	102 65
60	60 00	81 22	74 15
48	48 00	63 27	55 63
36	36 00	40 19	37 83
24	24 00	25 07	24 26
12	12 00	12 19	12 02

No. 24—LOS ANGELES.

LOS ANGELES BUILDING AND LOAN ASSOCIATION.

(Incorporated March 26, 1891.)

WILLIAM MEAD, Secretary. ABBOT KINNEY, President.

Fiscal year ends March 31, 1900.

No. of series, 18. No. of shares, 815½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$56,706 40	Installment stock—dues	$43,743 00
Arrearages		1,642 70	Paid-up and prepaid stock	6,000 00
On shares	$769 00		Earnings apportioned	18,821 12
On interest	846 70		Advance payments	50 00
On premiums	27 00		Reserve and undivided profits	68
Cash on hand and in bank		1,861 10		
Real estate owned		8,050 00		
Other assets		354 60		
Total assets		$68,614 80	Total liabilities	$68,614 80

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$667 26	Overdrafts and bills payable	$10,600 00
Installment stock—dues	10,315 00	Loans on mortgages and stock	19,610 25
Paid-up and prepaid stock	8,000 00	Interest paid	355 26
Interest received	6,031 15	Dues repaid — installment stock	8,849 00
Premiums received	852 15	Profits repaid — installment stock	2,617 24
Fines received	405 65	Paid-up and prepaid stock	2,000 00
Loans repaid	22,621 00	Salaries	600 00
Overdrafts and bills payable	4,000 00	Taxes	841 00
All other receipts	814 59	Other expenses	271 80
		All other disbursements	6,101 15
		Balance on hand and in bank	1,861 10
Total receipts	$53,706 80	Total disbursements	$53,706 80

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	70	$108 00	$176 61	$169 75
2	71½	102 00	163 20	159 02
3	25	96 00	150 21	139 37
4	20	90 00	137 71	125 78
5	25	84 00	125 51	113 05
6	15	78 00	113 79	99 97
7	11	72 00	102 50	93 01
8	28	66 00	91 62	82 30
9	72	60 00	81 17	72 35
10	65	54 00	71 15	63 72
11	50	48 00	61 55	55 68
12	10	42 00	52 38	47 14
13	60	36 00	43 62	39 78
14	66	30 00	35 29	32 25
15	118	24 00	27 39	25 44
16	4	18 00	19 90	18 81
17	76	12 00	12 83	12 36
18	29	6 00	6 21	6 00

No. 25—LOS ANGELES.

METROPOLITAN LOAN ASSOCIATION.

(Incorporated July 30, 1886.)

ISAAC NORTON, Secretary. CHAS. SEYLER, President.

Fiscal year ends June 30, 1899.

No. of series, 11. No. of shares, 4,264.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$250,300 00	Installment stock—dues	$179,112 00
Arrearages	152 00	Earnings apportioned	69,089 79
On shares $91 00		Reserve and undivided profits	2,122 42
On interest 61 00		Other liabilities	7,560 00
Cash on hand and in bank	4,108 46		
Real estate owned	3,323 75		
Total assets	$257,884 21	Total liabilities	$257,884 21

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$11,043 84	Loans on mortgages and stock	$77,690 00
Installment stock—dues	50,981 00	Dues repaid — installment stock	35,808 00
Interest received	18,663 85	Profits repaid — installment stock	20,750 60
Premiums received	11,290 00	Salaries	2,250 00
Fines received	427 30	Taxes	2,350 18
Fees received	104 40	Other expenses	846 57
Loans repaid	55,200 00	All other disbursements	4,204 73
All other receipts	298 15	Balance on hand and in bank	4,108 46
Total receipts	$148,008 54	Total disbursements	$148,008 54

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
6	121	$108 00	$199 53	$181 22
7	175	96 00	166 66	156 00
8	167	84 00	136 26	120 60
9	257	72 00	105 08	93 50
10	475	60 00	82 01	73 20
11	889	48 00	60 95	54 47
12	705	36 00	42 77	38 71
13	418	24 00	26 82	24 56
14	23	18 00	19 53	18 15
15	585	12 00	12 65	12 07
16	449	6 00	6 18	6 00

No. 26—LOS ANGELES.

MECHANICS SAVINGS MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated July 20, 1895.)

WM. BOSBYSHELL, Acting Secretary. WM. F. BOSBYSHELL, President.

Fiscal year ends July 31, 1899.

No. of series, 16. No. of shares, 859.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$15,718 00	Installment stock—dues	$12,372 00
Arrearages	42 00	Paid-up and prepaid stock	3,500 00
On shares $42 00		Earnings apportioned	2,759 83
Cash on hand and in bank	2,906 90	Advance payments	225 00
Other assets	713 86	Reserve and undivided profits	513 93
		Other liabilities	10 00
Total assets	$19,380 76	Total liabilities	$19,380 76

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,039 25	Overdrafts and bills payable	$1,000 00
Installment stock—dues	6,687 50	Loans on mortgages and stock	6,241 00
Paid-up and prepaid stock	1,859 78	Interest paid	341 10
Interest received	2,474 25	Dues repaid — installment stock	6,462 50
Fines received	59 71	Profits repaid — installment stock	1,041 33
Fees received	17 80	Paid-up and prepaid stock	2,929 78
Loans repaid	7,753 00	Salaries	550 00
Overdrafts and bills payable	1,000 00	Taxes	317 60
All other receipts	3,580 49	Other expenses	774 81
		All other disbursements	1,906 76
		Balance on hand and in bank	2,906 90
Total receipts	$24,471 78	Total disbursements	$24,471 78

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	185	$24 00	$31 25	$31 25
2	81	22 50	28 86	28 86
3	25	21 00	26 59	26 59
4	28	19 50	24 12	24 12
5	10	18 00	21 64	21 64
6	27	16 50	19 51	19 51
7	68	15 00	17 45	17 45
8	65	13 50	15 48	15 48
9	20	12 00	13 52	13 52
10	35	10 50	11 68	11 68
11	76	9 00	9 84	9 84
12	98	7 50	8 10	8 10
13	57	6 00	6 36	6 36
14	5	4 50	4 72	4 72
15	39	3 00	3 09	3 09
16	5	1 50	1 76	1 76

No. 27—LOS ANGELES.

PROVIDENT MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated October 14, 1895.)

G. H. WADLEIGH, Secretary. L. W. BLINN, President.

Fiscal year ends October 31, 1899.

No. of series, 16. No. of shares, 19,089½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$259,343 00	Installment stock—dues	$110,065 45
Arrearages		1,631 30	Paid-up and prepaid stock	101,250 00
On shares	$774 05		Earnings apportioned	22,904 41
On interest	431 60		Advance payments	6,359 27
On premiums	425 65		Overdrafts and bills payable	4,015 02
Cash on hand and in bank		538 58	Reserve and undivided profits	7,663 72
Real estate owned		1,000 00	Other liabilities	11,293 29
Other assets		1,038 28		
Total assets		$263,551 16	Total liabilities	$263,551 16

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$306 04	Overdrafts and bills payable	$65,781 75
Installment stock—dues	66,422 68	Loans on mortgages and stock	149,769 43
Paid-up and prepaid stock	65,950 00	Interest paid	893 92
Interest received	10,210 10	Dues repaid — installment stock	12,532 64
Premiums received	12,137 61	Profits repaid — installment stock	1,180 55
Fines received	138 86	Paid-up and prepaid stock and dividends	10,928 23
Fees received	17 75	Salaries	2,325 00
Loans repaid	34,470 00	Taxes	2,331 92
Overdrafts and bills payable	52,015 02	Other expenses	15,796 28
All other receipts	28,999 13	All other disbursements	8,588 89
		Balance on hand and in bank	538 58
Total receipts	$270,667 19	Total disbursements	$270,667 19

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Loan Fund Dues.*	Book Value per Share.	Withdrawal Value.
"A"—48 months—40 cts. per month	$19 20	$17 11	$23 17	$18 32
36 months	14 40	12 96	16 35	13 64
24 months	9 60	6 84	7 83	7 83
12 months	4 80	2 52	2 72	2 72
"B"—48 months—70 cts. per month	33 60	29 95	40 58	32 08
36 months	25 20	22 68	28 62	23 87
24 months	16 80	13 32	15 38	15 38
12 months	8 40	5 76	6 22	6 22
"C"—48 months—$1 15 per month	None.			
36 months	41 40	37 26	47 02	39 21
24 months	27 60	23 04	26 72	26 72
12 months	13 80	10 62	11 47	11 47

*Less maturity reserve, $2.00.

No. 28—LOS ANGELES.

PROTECTIVE SAVINGS MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated January 2, 1896.)

WM. GEO. BLEWETT, Secretary. W. J. PATTERSON, President.

Fiscal year ends February 28, 1900.

No. of series, 48. No. of shares, 14,199½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$215,980 27	Installment stock—dues	$60,901 24
Arrearages		4,540 97	Paid-up and prepaid stock	150,369 23
On shares	$1,291 90		Earnings apportioned	6,945 28
On interest	1,026 75		Advance payments	3,487 39
On premiums	1,026 75		Reserve and undivided profits	1,312 87
On fines, etc.	1,195 57		Other liabilities	33,778 21
Cash on hand and in bank		18,684 26		
Real estate owned		702 77		
Other assets, including $9,242 26 contingent		16,885 95		
Total assets		$256,794 22	Total liabilities	$256,794 22

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,392 78	Loans on mortgages and stock	$114,406 18
Installment stock—dues	52,002 85	Interest paid	119 52
Paid-up and prepaid stock	72,012 44	Dues repaid — installment stock	10,581 94
Interest received	8,629 19	Profits repaid — installment stock	3,409 00
Premiums received	8,619 93	Paid-up and prepaid stock and dividends	23,445 26
Fines received	996 04	Salaries	3,571 03
Fees received	665 40	Taxes	2,216 44
Loans repaid	43,042 40	Other expenses	11,491 55
All other receipts	6,431 69	All other disbursements	6,867 54
		Balance on hand and in bank	18,684 26
Total receipts	$194,792 72	Total disbursements	$194,792 72

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Loan Fund Dues.	Book Value per Share.	Withdrawal Value.
"A"—48 months—$1 25 per month	$60 00	$48 50	$59 81	Loan fund and 5% to 6% for average time.
"B"—48 months— 1 00 per month	48 00	37 20	46 34	
"C"—48 months— 75 per month	36 00	29 80	35 79	
"D"—48 months— 60 per month	28 80	22 32	27 78	
"E"—48 months— 45 per month	21 60	16 74	20 80	
"F"—48 months— 25 per month	12 00	9 30	11 57	

No. 29—LOS ANGELES.

STATE MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated June 20, 1889.)

C. J. WADE, Secretary. W. G. COCHRAN, President.

Fiscal year ends December 31, 1899.

No. of series, none. No. of shares, 23,049.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$555,010 75	Installment stock—dues	$287,104 50
Arrearages		1,902 35	Paid-up and prepaid stock	183,912 50
On interest	$1,235 85		Earnings apportioned	130,418 30
On premiums	457 40		Advance payments	268 70
On fines, etc.	209 10		Reserve and undivided profits	2,944 98
Cash on hand and in bank		33,986 05	Other liabilities	462 10
Real estate owned		9,421 91		
Other assets		4,790 02		
Total assets		$605,111 08	Total liabilities	$605,111 08

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$11,121 10	Loans on mortgages and stock	$203,264 65
Installment stock—dues	142,269 80	Interest refunded	179 20
Interest received	51,548 79	Dues repaid — installment stock	150,667 90
Premiums received	7,588 05	Profits repaid — installment stock	42,983 45
Fines received	1,440 75	Paid-up and prepaid stock, and dividends	22,799 00
Fees received	985 20	Salaries	5,460 00
Loans repaid	242,657 15	Taxes	2,025 10
All other receipts	24,837 80	Other expenses	7,238 68
		All other disbursements	13,844 61
		Balance on hand and in bank	33,986 05
Total receipts	$482,448 64	Total disbursements	$482,448 64

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Loan Fund Dues.	Book Value per Share.	Withdrawal Value.
108 months—Loan Fund stock	$64 80	$55 75	$94 65	$94 65
96 months—Loan Fund stock	57 60	*48 56	76 11	76 11
84 months—Loan Fund stock	50 40	*42 40	62 18	62 18
72 months—Loan Fund stock	43 20	*36 20	49 75	49 72
60 months—Loan Fund stock	36 00	*30 00	38 72	38 72
48 months—Net Dividend plan	28 80	*27 80	32 48	32 48
36 months—Net Dividend plan	21 60	*20 60	22 98	22 98
24 months—Net Dividend plan	14 40	*13 40	14 31	14 31
12 months—Net Dividend plan	7 20	* 6 20	6 38	6 38
6 months—Net Dividend plan	3 60	* 2 60	2 63	2 63

* Less admission fee, $1.00.

No. 30—LOS ANGELES.

SAVINGS FUND AND BUILDING SOCIETY.

(Incorporated March 13, 1883.)

E. H. Grasett, Secretary. J. F. Holbrook, President.

Fiscal year ends August 31, 1899.

No. of series, 9. No. of shares, 1,011.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$72,750 00	Installment stock—dues	$66,780 00
Arrearages		68 35	Earnings apportioned	23,323 79
On shares	$28 00		Reserve and undivided profits	6 66
On interest	37 35		Unearned premiums	6,604 64
On fines, etc.	3 00		Other liabilities	765 77
Cash on hand and in bank		15,157 24		
Real estate owned		9,256 20		
Other assets		249 07		
Total assets		$97,480 86	Total liabilities	$97,480 86

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$8,786 97	Loans on mortgages and stock	$5,650 00
Installment stock—dues	13,712 00	Dues repaid — installment stock	22,473 00
Interest received	7,383 41	Profits repaid — installment stock	13,609 74
Premiums received	2,268 39	Salaries	916 00
Fines received	60 68	Taxes	970 14
Fees received	8 70	Other expenses	311 18
Loans repaid	29,725 00	All other disbursements	3,846 05
All other receipts	988 20	Balance on hand and in bank	15,157 24
Total receipts	$62,933 35	Total disbursements	$62,933 35

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
8	77	$108 00	$174 58	$167 93
9	208	96 00	142 30	135 36
10	94	84 00	114 83	108 67
11	161	72 00	91 28	86 46
12	163	60 00	71 15	67 81
13	77	48 00	53 79	51 77
14	108	36 00	38 53	39 24
15	14	24 00	24 84	25 20
16	108	12 00	12 15	12 24

No. 31—LOS ANGELES.

STATE OF CALIFORNIA MUTUAL BUILDING AND LOAN ASSOCIATION.

(Reincorporated March, 1898.)

W. L. VALENTINE, Secretary. GEORGE EASTON, President.

Fiscal year ends February 28, 1900.

No. of series, none. No. of shares, 1,714½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$47,793 00	Installment stock—dues	$6,936 87
Arrearages		1,071 08	Paid-up and prepaid stock	44,565 50
On shares	$77 00		Earnings apportioned	1,149 38
On interest	807 45		Reserve and undivided profits	3,064 91
On premiums	163 63			
On fines, etc.	23 00			
Cash on hand and in bank		5,812 63		
Other assets		1,039 95		
Total assets		$55,716 66	Total liabilities	$55,716 66

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,718 29	Overdrafts and bills payable	$5,000 00
Installment stock—dues	5,510 60	Loans on mortgages and stock	45,047 00
Paid-up and prepaid stock	32,404 00	Interest paid	342 80
Interest received	4,159 05	Dues repaid — installment stock	1,736 20
Premiums received	3,127 41	Profits repaid — installment stock	220 08
Fines received	72 97	Paid-up and prepaid stock	5,650 00
Fees received	815 00	Salaries	1,864 46
Loans repaid	22,316 57	Taxes	156 70
All other receipts	950 94	Other expenses	929 99
		All other disbursements	5,314 97
		Balance on hand and in bank	5,812 63
Total receipts	$72,074 83	Total disbursements	$72,074 83

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
18 months—Class A	$10 80	$11 63	$10 40
12 months—Class A	7 20	7 56	6 38
6 months—Class A	3 60	3 66	2 66

No. 32—LOS ANGELES.

SOUTHERN CALIFORNIA LOAN ASSOCIATION.

(Incorporated March 11, 1887.)

JULIUS H. MARTIN, Secretary. C. E. DONNOTIN, President.

Fiscal year ends August 31, 1899.

No. of series, 17. No. of shares, 4,846.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$298,298 00	Installment stock—dues	$214,386 00
Arrearages	778 00	Paid-up and prepaid stock	14,000 00
On shares $778 00		Earnings apportioned	69,169 44
Cash on hand and in bank	1,655 85	Advance payments	646 00
Real estate owned	1,507 15	Reserve and undivided profits	1,731 30
Other assets	395 21	Other liabilities	2,701 47
Total assets	$302,634 21	Total liabilities	$302,634 21

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$6,564 67	Loans on mortgages and stock	$33,323 24
Installment stock—dues	57,489 00	Interest paid on full paid stock	1,616 50
Interest received	26,097 12	Dues repaid — installment stock	36,415 00
Premiums received	1,720 99	Profits repaid — installment stock	18,726 99
Fines received	297 00	Paid-up and prepaid stock	16,300 00
Loans repaid	23,625 00	Salaries	1,729 00
All other receipts	83 56	Taxes	4,076 07
		Other expenses	429 73
		All other disbursements	1,604 96
		Balance on hand and in bank	1,655 85
Total receipts	$115,877 34	Total disbursements	$115,877 34

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
103	$103 00	$163 71	$163 71
91	91 00	134 86	123 90
85	85 00	122 15	112 86
72	72 00	96 99	86 99
60	60 00	76 50	69 90
48	48 00	57 93	52 96
36	36 00	41 27	38 63
24	24 00	26 13	25 06
12	12 00	12 50	12 25

No. 33—LOS ANGELES.

UNION MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated October 8, 1891.)

HARVEY STURTEVANT, Secretary. E. P. JOHNSON, President.

Fiscal year ends October 31, 1899.

No. of series, 32. No. of shares, 7,260.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$177,923 82	Installment stock—dues	$132,228 00
Arrearages		11,276 95	Paid-up and prepaid stock	62,508 41
On shares	$7,933 50		Earnings apportioned	27,361 05
On interest	2,133 89		Reserve and undivided profits	2,786 03
On premiums	1,044 06		Other liabilities	1,228 88
On fines, etc.	165 50			
Cash on hand and in bank		9,739 51		
Real estate owned		7,894 48		
Other assets		19,277 61		
Total assets		$226,112 37	Total liabilities	$226,112 37

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$5,212 47	Overdrafts and bills payable	$9,047 35
Installment stock—dues	43,651 78	Loans on mortgages and stock	48,469 97
Paid-up and prepaid stock	14,000 00	Interest paid	684 77
Interest received	11,296 99	Dues repaid — installment stock	46,798 97
Premiums received	9,070 52	Profits repaid — installment stock	6,813 81
Fines received	121 63	Paid-up and prepaid stock and dividends	10,534 99
Fees received	181 48	Salaries	3,840 00
Loans repaid	67,802 96	Taxes	2,258 09
Overdrafts and bills payable	4,500 00	Other expenses	5,584 18
All other receipts	7,638 56	All other disbursements	19,704 75
		Balance on hand and in bank	9,739 51
Total receipts	$163,476 39	Total disbursements	$163,476 39

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Loan Fund Dues.	Book Value per Share.	Withdrawal Value.
96	$57 60	$49 20	$64 61	$61 37
84	50 40	43 20	54 99	51 40
72	43 20	37 20	46 48	41 55
60	36 00	31 20	38 19	31 75
48	28 80	25 20	29 74	25 20
36	21 60	19 20	21 63	19 20
24	14 40	13 20	14 22	13 20
12	7 20	7 20	7 20	7 20

No. 34—LOS GATOS.

LOS GATOS BUILDING AND LOAN ASSOCIATION.

(Incorporated April 27, 1889.)

A. BERRYMAN, Secretary. P. SIMON, President.

Fiscal year ends April 30, 1900.

No. of series, 5. No. of shares, 125¼.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$16,000 00	Installment stock—dues	$6,771 00
Cash on hand and in bank	1,065 79	Earnings apportioned	1,736 51
		Advance payments	1 50
		Overdrafts and bills payable	8,300 00
		Reserve and undivided profits	248 28
		Other liabilities	8 50
Total assets	$17,065 79	Total liabilities	$17,065 79

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,633 00	Interest paid	$121 20
Installment stock—dues	2,357 50	Dues repaid — installment stock	15,503 00
Interest received	1,508 25	Profits repaid — installment stock	9,102 00
Premiums received	341 60	Salaries	300 00
Fines received	12 95	Taxes	356 11
Fees received	2 20	Other expenses	34 45
Loans repaid	12,400 00	All other disbursements	83 95
Overdrafts and bills payable	8,300 00	Balance on hand and in bank	1,065 79
All other receipts	11 00		
Total receipts	$26,566 50	Total disbursements	$26,566 50

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	46	46	$84 00	$111 17	Dues
3	8	8	72 00	91 44	and
4	14½	14½	48 00	56 48	3 to 6%
5	34¾	39¾	36 00	40 96	interest.
6	----	17	12 00	12 65	

No. 35—MERCED.

MERCED MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated June 22, 1891.)

M. D. Wood, Secretary. George Conway, President.

Fiscal year ends June 30, 1899.

No. of series, 9. No. of shares, 434.

Financial Statement.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$36,699 00	Installment stock—dues	$24,624 00
Arrearages	267 45	Earnings apportioned	8,461 14
On shares $136 00		Overdrafts and bills payable	1,100 00
On interest 111 40		Reserve and undivided profits	17 78
On fines, etc. 20 05		Unearned premiums	4,405 89
Cash on hand and in bank	75 36		
Real estate owned	1,475 00		
Other assets	92 00		
Total assets	$38,608 81	Total liabilities	$38,608 81

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$4,023 85	Loans on mortgages and stock	$15,230 00
Installment stock—dues	6,518 00	Interest paid	38 50
Interest received	3,071 30	Dues repaid — installment stock	13,936 00
Premiums received	2,733 80	Profits repaid — installment stock	4,181 06
Fines received	180 66	Salaries	240 00
Fees received	8 90	Taxes	463 92
Loans repaid	18,166 00	Other expenses	169 30
Overdrafts and bills payable	1,100 00	All other disbursements	1,609 12
All other receipts	140 75	Balance on hand and in bank	75 36
Total receipts	$35,943 26	Total disbursements	$35,943 26

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	128	$96 00	$138 10	$123 16
2	15	90 00	126 29	113 88
3	40	84 00	114 98	104 82
4	15	78 00	104 18	95 97
6	15	60 00	74 27	70 67
7	35	48 00	56 94	54 86
8	40	36 00	40 86	39 88
9	57	24 00	26 16	25 75
10	89	12 00	12 58	12 45

No. 36—MODESTO.

MODESTO BUILDING AND LOAN ASSOCIATION.

(Incorporated August 10, 1889.)

G. P. SCHAFER, Secretary. A. HEWEL, President.

Fiscal year ends December 31, 1899.

No. of series, 6. No. of shares, 209.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$18,475 06	Installment stock—dues	$17,094 00
Arrearages		65 82	Earnings apportioned	9,032 83
On shares	$45 00		Reserve and undivided profits	1,867 72
On interest	14 82		Other liabilities	11 71
Cash on hand and in bank		565 38		
Real estate owned		8,900 00		
Total assets		$28,006 26	Total liabilities	$28,006 26

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,272 70	Interest paid	$2 19
Installment stock—dues	2,420 00	Dues repaid — installment stock	21,224 00
Interest received	1,372 37	Profits repaid — installment stock	10,181 88
Fines received	24 50	Salaries	240 00
Fees received	6 55	Taxes	424 51
Loans repaid	27,145 00	Other expenses	48 71
All other receipts	577 30	All other disbursements	131 75
		Balance on hand and in bank	565 38
Total receipts	$32,818 42	Total disbursements	$32,818 42

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	81	$122 00	$200 00	$200 00
2	40	108 00	156 44	132 22
3	19	96 00	127 64	111 82
4	7	84 00	105 43	94 71
6	2	60 00	67 93	63 96
7	60	6 00	6 17	6 00

No. 37—NAPA.

NAPA BUILDING AND LOAN ASSOCIATION.

(Incorporated April 22, 1886.)

T. N. MOUNT, Secretary. E. D. BEARD, President.

Fiscal year ends May 20, 1900.

No. of series, 11. No. of shares, 1,080.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$104,401 33	Installment stock—dues	$73,897 00
Arrearages		243 38	Earnings apportioned	34,298 18
On shares	$44 00		Advance payments	185 00
On interest	45 10		Reserve and undivided profits	245 96
On fines, etc.	154 28			
Cash on hand and in bank		1,912 09		
Real estate owned		1,821 34		
Other assets		248 00		
Total assets		$108,626 14	Total liabilities	$108,626 14

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$11,885 00	Overdrafts and bills payable	$5,153 18
Interest received	8,313 32	Loans on mortgages and stock	8,686 33
Premiums received	2 40	Interest paid	142 12
Fines received	108 07	Dues repaid — installment stock	26,844 00
Fees received	1 60	Profits repaid — installment stock	14,546 32
Loans repaid	31,245 00	Salaries	560 00
Overdrafts and bills payable	5,000 00	Taxes	1,391 39
All other receipts	3,054 00	Other expenses	217 36
		All other disbursements	156 60
		Balance on hand and in bank	1,912 09
Total receipts	$59,609 39	Total disbursements	$59,609 39

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE AT AGES INDICATED.

Serial No.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
5	$125 00	$191 59	$157 55
6	113 00	166 36	139 59
7	101 00	142 59	122 25
8	89 00	120 29	105 49
9	77 00	99 45	89 45
10	65 00	80 08	73 79
11	53 00	62 11	58 85
12	41 00	45 73	44 69
13	29 00	30 76	30 50
14	17 00	17 29	17 28
15	5 00	5 08	5 05

No. 38—NEWCASTLE.

NEWCASTLE BUILDING AND LOAN ASSOCIATION.

(Incorporated May 22, 1889.)

ED. KATZENSTEIN, Secretary. C. H. KELLOGG, President.

Fiscal year ends May 26, 1900.

No. of series, 10. No. of shares, 248.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$13,100 00	Installment stock—dues	$11,316 00
Cash on hand and in bank	1,667 75	Earnings apportioned	4,344 80
Real estate owned	1,100 00	Advance payments	7 00
Other assets	50 00	Reserve and undivided profits	41 63
		Unearned premiums	208 32
Total assets	$15,917 75	Total liabilities	$15,917 75

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$287 23	Overdrafts and bills payable	$2,250 00
Installment stock—dues	3,121 00	Loans on mortgages and stock	1,200 00
Interest received	1,145 75	Interest paid	105 85
Premiums received	281 75	Dues repaid — installment stock	1,765 00
Fines received	199 89	Profits repaid — installment stock	1,149 14
Fees received	6 90	Salaries	326 00
Loans repaid	1,800 00	Taxes	351 33
All other receipts	2,183 00	Other expenses	186 09
		All other disbursements	24 36
		Balance on hand and in bank	1,667 75
Total receipts	$9,025 52	Total disbursements	$9,025 52

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	15	$120 00	$200 00	$200 00
3	1	108 00	172 80	166 32
4	12	96 00	147 20	141 08
5	13	84 00	123 20	115 36
6	27	72 00	100 80	92 16
7	35	60 00	80 00	70 00
8	15	48 00	60 80	53 12
9	9	36 00	43 20	38 16
10	52	24 00	27 20	24 64
11	69	12 00	12 80	12 04

No. 39—OAKLAND.

EQUITY BUILDING AND LOAN ASSOCIATION.

(Incorporated August 21, 1888.)

G. A. WILLARD, Secretary. J. B. McCHESNEY, President.

Fiscal year ends June 30, 1899.

No. of series, 18. No. of shares, 362¼.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$39,290 78	Installment stock—dues	$8,718 50
Arrearages		367 30	Paid-up and prepaid stock, and dividends	44,513 60
On shares	$114 00		Earnings apportioned	1,980 28
On interest	139 15		Overdrafts and bills payable	16,900 00
On premiums	59 85		Other liabilities	25 83
On fines, etc.	54 30			
Cash on hand and in bank		2,450 06		
Real estate owned		28,830 00		
Other assets		1,200 07		
Total assets		$72,138 21	Total liabilities	$72,138 21

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,992 51	Overdrafts and bills payable	$7,502 50
Installment stock—dues	2,881 22	Loans on mortgages and stock	9,124 60
Paid-up and prepaid stock	2,400 65	Interest paid	827 94
Interest received	3,734 08	Dues repaid — installment stock	7,681 50
Premiums received	1,279 97	Profits repaid — installment stock	3,231 15
Fines received	114 00	Paid-up and prepaid stock, and dividends	11,651 40
Fees received	33 45	Salaries	2,302 00
Loans repaid	24,524 35	Taxes	1,055 04
Overdrafts and bills payable	7,500 00	Other expenses	272 32
All other receipts	2,527 01	All other disbursements	2,888 73
		Balance on hand and in bank	2,450 06
Total receipts	$48,987 24	Total disbursements	$48,987 24

INSTALLMENT STOCK, WITH AGE, VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
120	$120 00	$191 36	$120 00
102	102 00	156 27	102 00
96	96 00	141 86	96 00
84	84 00	115 60	84 00
72	72 00	90 69	72 00
60	60 00	72 43	60 00
48	48 00	50 23	48 00
36	36 00	36 12	36 00
24	24 00	24 00	24 00
12	12 00	12 00	12 00

No. 40—OAKLAND.

HOME SECURITY BUILDING AND LOAN ASSOCIATION.

(Incorporated December 20, 1874.)

C. K. CLARK, Secretary. C. E. PALMER, President.

Fiscal year ends June 30, 1899.

No. of series, 26. No. of shares, 3,297.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$252,415 10	Installment stock—dues	$177,814 50
Arrearages		9,396 65	Paid-up and prepaid stock	50,100 00
On shares	$4,177 00		Earnings apportioned	66,843 64
On interest	4,792 60		Advance payments	646 00
On fines, etc.	427 05		Overdrafts and bills payable	4,792 67
Real estate owned		59,484 80	Reserve and undivided profits	11,705 17
Other assets		2,436 20	Other liabilities	11,830 77
Total assets		$323,732 75	Total liabilities	$323,732 75

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$5,005 61	Loans on mortgages and stock	$86,116 00
Installment stock—dues	39,042 50	Interest paid	680 26
Paid-up and prepaid stock	26,525 00	Dues repaid — installment stock	75,249 00
Interest received	24,654 77	Profits repaid — installment stock	30,758 04
Premiums received	6,246 05	Paid-up and prepaid stock and dividends	40,592 15
Fines received	478 30	Salaries	2,484 00
Fees received	27 55	Taxes	4,227 59
Loans repaid	139,140 50	Other expenses	1,155 73
Overdrafts and bills payable	4,792 67	All other disbursements	23,513 17
All other receipts	18,862 99		
Total receipts	$264,775 94	Total disbursements	$264,775 94

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
120	$120 00	$184 96	$181 70
108	108 00	158 98	156 45
96	96 00	135 04	131 15
84	84 00	112 96	107 20
72	72 00	92 61	86 45
60	60 00	73 86	68 30
48	48 00	56 57	53 80
36	36 00	40 63	37 35
24	24 00	25 93	25 50
12	12 00	12 50	12 40

No. 42—OAKLAND.

STANDARD BUILDING AND LOAN ASSOCIATION.

(Incorporated October 1, 1890.)

H. F. KELLOGG, Secretary. CHARLES W. KELLOGG, President.

Fiscal year ends October 27, 1899.

No. of series, 17. No. of shares, 418½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$35,800 00	Installment stock—dues	$26,397 00
Arrearages		2,806 85	Paid-up and prepaid stock	4,750 00
On shares	$960 00		Earnings apportioned	10,558 82
On interest	1,199 90		Advance payments	22 00
On premiums	493 85		Overdrafts and bills payable	5,000 00
On fines, etc.	153 10		Reserve and undivided profits	647 75
Cash on hand and in bank		2,376 73	Other liabilities	2,164 76
Real estate owned		8,056 75		
Other assets		500 00		
Total assets		$49,540 33	Total liabilities	$49,540 33

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$4,463 21	Overdrafts and bills payable	$500 00
Installment stock—dues	5,284 00	Loans on mortgages and stock	2,275 00
Paid-up and prepaid stock	3,050 00	Interest paid	271 33
Interest received	2,443 07	Dues repaid — installment stock	12,978 00
Premiums received	931 39	Profits repaid — installment stock	3,574 60
Fines received	20 20	Paid-up and prepaid stock	700 00
Fees received	8 20	Salaries	600 00
Loans repaid	4,100 00	Taxes	551 55
Overdrafts and bills payable	5,000 00	Other expenses	268 59
All other receipts	7,326 36	All other disbursements	8,530 63
		Balance on hand and in bank	2,376 73
Total receipts	$32,626 43	Total disbursements	$32,626 43

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	63	$108 00	$168 65	$137 16
2	31½	102 00	154 08	128 01
3	17	96 00	140 82	119 04
4	27	90 00	128 73	110 25
5	17	84 00	116 53	101 64
6	41	78 00	105 56	93 21
7	21	72 00	94 56	84 96
8	7	66 00	84 72	76 89
9	30	60 00	74 90	69 00
10	11	54 00	65 98	61 29
11	10	48 00	57 12	53 76
12	21	42 00	49 10	46 41
13	10	36 00	41 11	39 24
14	12	30 00	33 75	32 25
15	18	24 00	26 39	25 44
17	53	12 00	12 65	12 18
18	29	6 00	6 32	6 00

No. 43—EAST OAKLAND.

BROOKLYN INVESTMENT AND LOAN ASSOCIATION.

(Incorporated October 14, 1889.)

I. I. BOOK, Secretary. C. H. DALY, President.

Fiscal year ends October 31, 1899.

No. of series, 36. No. of shares, 2,050½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$37,263 15	Installment stock—dues	$50,202 38
Arrearages		1,802 08	Earnings apportioned	10,828 59
On shares	$660 38		Advance payments	204 40
On interest	766 95		Reserve and undivided profits	344 19
On premiums	264 80		Other liabilities	750 83
On fines, etc.	109 95			
Cash on hand and in bank		561 43		
Real estate owned		22,224 53		
Other assets		479 20		
Total assets		$62,330 39	Total liabilities	$62,330 39

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,729 03	Overdrafts and bills payable	$2,150 00
Installment stock—dues	13,950 25	Loans on mortgages and stock	6,910 00
Interest received	3,091 28	Interest paid	63 00
Premiums received	1,179 00	Dues repaid — installment stock	19,303 25
Fines received	111 65	Profits repaid — installment stock	2,174 82
Loans repaid	11,647 00	Salaries	600 00
Overdrafts and bills payable	2,150 00	Taxes	1,092 90
All other receipts	2,065 29	Other expenses	274 15
		All other disbursements	3,793 95
		Balance on hand and in bank	561 43
Total receipts	$36,923 50	Total disbursements	$36,923 50

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
108	$54 00	$75 99	$66 09
102	51 00	69 32	61 81
96	48 00	63 35	57 60
90	45 00	57 60	53 37
84	42 00	52 50	49 31
78	39 00	47 64	45 32
72	36 00	43 10	41 40
66	33 00	38 79	37 49
60	30 00	34 66	33 72
54	27 00	30 76	30 02
48	24 00	26 95	26 46
42	21 00	23 26	22 80
36	18 00	19 67	19 33
30	15 00	16 18	15 93
24	12 00	12 76	12 50
18	9 00	9 44	9 27
12	6 00	6 20	6 12
6	3 00	3 05	3 03

No. 44—EAST OAKLAND.

COSMOPOLITAN MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated August 4, 1879.)

W. S. GOULD, Secretary. D. SYMMES, President.

Fiscal year ends July 31, 1899.

No. of series, 21. No. of shares, 1,786½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$91,432 22	Installment stock—dues	$97,630 50
Arrearages		4,504 02	Earnings apportioned	28,296 48
On shares	$1,545 49		Advance payments	1,761 26
On interest	1,978 68		Overdrafts and bills payable	9,400 00
On premiums	668 10		Reserve and undivided profits	1,043 39
On fines, etc.	291 75		Unearned premiums	38 02
Cash on hand and in bank		1,980 93	Other liabilities	1,039 50
Real estate owned		28,628 96		
Other assets		12,663 02		
Total assets		$139,209 15	Total liabilities	$139,209 15

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$6,741 25	Overdrafts and bills payable	$10,450 00
Installment stock—dues	24,123 68	Loans on mortgages and stock	9,918 48
Interest received	7,325 49	Interest paid	852 59
Premiums received	1,986 05	Dues repaid — installment stock	30,577 80
Fines received	278 50	Profits repaid — installment stock	9,794 92
Loans repaid	33,475 00	Salaries	1,720 00
Overdrafts and bills payable	1,820 26	Taxes	2,044 92
All other receipts	21,151 17	Other expenses	489 71
		All other disbursements	29,072 05
		Balance on hand and in bank	1,980 93
Total receipts	$96,901 40	Total disbursements	$96,901 40

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
120	$120 00	$181 46	$178 39
108	108 00	154 37	147 41
96	96 00	129 52	121 14
84	84 00	107 28	99 13
72	72 00	87 74	80 66
60	60 00	70 05	65 02
48	48 00	53 97	50 98
36	36 00	39 15	37 57
24	24 00	25 33	24 66
12	12 00	12 33	12 16

No. 45—EAST OAKLAND.

OAKLAND BUILDING AND LOAN ASSOCIATION.

(Incorporated April 24, 1890.)

C. C. MOYLE, Secretary. AUSTIN J. ROBERTS, President.

Fiscal year ends December 31, 1899.

No. of series, 48. No. of shares, 1,477.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$87,133 00	Installment stock—dues	$58,054 84
Arrearages		4,666 50	Earnings apportioned	16,192 72
On shares	$1,755 50		Advance payments	60 76
On interest	2,016 51		Overdrafts and bills payable	24,671 79
On premiums	160 80		Reserve and undivided profits	6,761 82
On fines, etc.	733 69		Other liabilities	41,099 92
Cash on hand and in bank		462 78		
Real estate owned		50,202 72		
Other assets		4,376 85		
Total assets		$146,841 85	Total liabilities	$146,841 85

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$487 55	Overdrafts and bills payable	$6,000 00
Installment stock—dues	43,264 48	Loans on mortgages and stock	20,713 00
Interest received	10,205 34	Interest paid	4,432 00
Premiums received	593 75	Dues repaid — installment stock	57,005 90
Fines received	428 46	Profits repaid — installment stock	12,679 88
Loans repaid	58,102 00	Paid-up and prepaid stock	250 00
Overdrafts and bills payable	671 89	Salaries	1,290 00
All other receipts	38,675 55	Taxes	1,781 19
		Other expenses	574 26
		All other disbursements	47,240 01
		Balance on hand and in bank	462 78
Total receipts	$152,429 02	Total disbursements	$152,429 02

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
120	$60 00	$104 66	$100 00
110	55 00	85 26	77 68
96	48 00	68 52	63 42
84	42 00	56 07	51 84
70	35 00	43 45	39 64
62	31 00	37 08	34 34
48	24 00	27 17	25 58
41	20 50	22 79	21 64
19	9 50	9 98	9 74

No. 46—WEST OAKLAND.

WEST OAKLAND MUTUAL LOAN ASSOCIATION.

(Incorporated July 21, 1875.)

A. SBARBORO, Secretary. C. A. MALM, President.

Fiscal year ends August 31, 1899.

No. of series, 12. No. of shares, 1,017.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$82,200 00	Installment stock—dues	$76,068 00
Arrearages		944 20	Earnings apportioned	15,913 46
On shares	$389 00		Advance payments	276 00
On interest	325 00		Reserve and undivided profits	1,161 93
On premiums	15 50		Other liabilities	50 00
On fines, etc.	214 70			
Cash on hand and in bank		$2,976 45		
Real estate owned		6,672 07		
Other assets		676 67		
Total assets		$93,469 39	Total liabilities	$93,469 39

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$6,557 30	Loans on mortgages and stock	$3,400 00
Installment stock—dues	13,302 00	Interest paid	103 75
Interest received	5,331 03	Dues repaid — installment stock	25,521 50
Premiums received	270 00	Profits repaid — installment stock	5,996 52
Fines received	48 35	Salaries	1,500 00
Fees received	18 60	Taxes	1,114 92
Loans repaid	16,400 00	Other expenses	422 53
All other receipts	2,541 24	All other disbursements	3,432 85
		Balance on hand and in bank	2,976 45
Total receipts	$44,468 52	Total disbursements	$44,468 52

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
11	61	$144 00	$192 78	$180 58
12	62	132 00	172 66	162 49
13	59	120 00	151 48	143 61
14	165	108 00	133 55	127 16
15	58	96 00	114 57	109 92
16	98½	84 00	97 76	94 32
17	111	72 00	81 27	78 95
18	60	60 00	66 02	63 61
19	64	48 00	51 71	49 85
20	64½	36 00	38 23	37 11
21	67	24 00	25 13	24 56
22	147	12 00	12 43	12 21

No. 47—ONTARIO.

PEOPLE'S MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated June 24, 1891.)

I. S. MILLER, Secretary. A. P. HARWOOD, President.

Fiscal year ends May 31, 1900.

No. of series, none. No. of shares, 1,456.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$69,100 00	Installment stock—dues	$55,112 18
Cash on hand and in bank	1,060 83	Earnings apportioned	4,028 64
Real estate owned	1,017 84	Overdrafts and bills payable	11,875 00
Other assets	179 09	Reserve and undivided profits	4 11
		Other liabilities	337 83
Total assets	$71,357 76	Total liabilities	$71,357 76

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,760 02	Overdrafts and bills payable	$3,075 00
Installment stock—dues	10,095 99	Loans on mortgages and stock	21,232 92
Interest received	6,021 37	Interest paid	261 06
Fines received	169 18	Dues repaid — installment stock	20,000 00
Loans repaid	13,768 36	Profits repaid—installment stock	1,929 79
Overdrafts and bills payable	14,750 00	Salaries	600 00
All other receipts	245 66	Other expenses	319 80
		All other disbursements	331 18
		Balance on hand and in bank	1,060 83
Total receipts	$48,810 58	Total disbursements	$48,810 58

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
102	$61 20	$104 11	$103 07
90	54 00	86 30	85 44
78	46 80	70 02	69 32
60	36 00	48 46	47 98
48	28 80	36 82	36 46
36	21 60	25 09	24 84
24	14 40	15 71	15 56
18	10 80	11 46	11 37

No. 48—ORANGE.

ORANGE BUILDING AND LOAN ASSOCIATION.

(Incorporated September 21, 1887.)

W. H. H. CLAYTON, Secretary. D. C. PIXLEY, President.

Fiscal year ends October 31, 1899.

No. of series, 5. No. of shares, 845⅞.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$39,375 00	Installment stock—dues	$29,879 25
Arrearages		321 97	Earnings apportioned	4,477 67
On shares	$158 21		Advance payments	1,688 90
On interest	96 25		Overdrafts and bills payable	4,965 00
On premiums	38 50		Reserve and undivided profits	13 63
On fines, etc.	29 01		Other liabilities	282 28
Cash on hand and in bank		1,498 26		
Other assets		111 50		
Total assets		$41,306 73	Total liabilities	$41,306 73

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,012 81	Overdrafts and bills payable	$3,710 80
Installment stock—dues	10,601 74	Loans on mortgages and stock	13,825 00
Interest received	2,027 57	Interest paid	485 94
Premiums received	837 64	Dues repaid — installment stock	869 00
Fines received	37 29	Profits repaid — installment stock	68 80
Loans repaid	6,890 00	Salaries	150 00
All other receipts	72 07	Taxes	25 50
		Other expenses	76 10
		All other disbursements	769 72
		Balance on hand and in bank	1,498 26
Total receipts	$21,479 12	Total disbursements	$21,479 12

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	224½	$54 00	$64 83	$59 41
3	194½	42 00	48 00	44 40
4	226⅜	30 00	33 13	30 63
5	132¾	18 00	19 17	18 12
6	67¾	6 00	6 23	6 00

No. 49—PALO ALTO.

PALO ALTO MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated November 14, 1892.)

MARSHALL BLACK, Secretary. J. S. BUTLER, President.

Fiscal year ends November 30, 1899.

No. of series, 17. No. of shares, 645.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$36,150 00	Installment stock—dues	$21,310 00
Arrearages		407 80	Earnings apportioned	6,295 46
On shares	$263 00		Advance payments	691 00
On interest	84 55		Overdrafts and bills payable	8,425 00
On premiums	31 50		Reserve and undivided profits	273 37
On fines, etc.	28 75		Other liabilities	5 50
Cash on hand and in bank		364 81		
Other assets		77 72		
Total assets		$37,000 33	Total liabilities	$37,000 33

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$235 38	Overdrafts and bills payable	$6,400 00
Installment stock—dues	6,832 00	Loans on mortgages and stock	10,342 00
Interest received	2,831 10	Interest paid	728 30
Premiums received	997 85	Dues repaid — installment stock	3,570 00
Fines received	12 65	Profits repaid — installment stock	615 35
Fees received	16 70	Salaries	300 00
Loans repaid	6,650 00	Taxes	620 62
Overdrafts and bills payable	5,400 00	Other expenses	34 60
		Balance on hand and in bank	364 81
Total receipts	$22,975 68	Total disbursements	$22,975 68

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
84	$84 00	$120 86	$104 58
71	71 00	97 16	85 80
60	60 00	77 74	70 50
45	45 00	55 19	48 85
36	36 00	42 49	39 24
24	24 00	26 86	25 44
18	18 00	19 52	18 50
12	12 00	12 71	12 35

No. 50—PASADENA.

LOS ANGELES COUNTY MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated February 16, 1899.)

ISAAC SPRINGER, Secretary. SOLON BRIGGS, President.

Fiscal year ends December 31, 1899.

No. of series, none. No. of shares, 1,383.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$14,875 00	Installment stock—dues	$4,393 79
Cash on hand and in bank	1,444 94	Paid-up and prepaid stock	11,700 00
Other assets	94 25	Earnings apportioned	261 55
		Reserve and undivided profits	5 55
		Other liabilities	53 30
Total assets	$16,414 19	Total liabilities	$16,414 19

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$4,799 98	Overdrafts and bills payable	$600 00
Paid-up and prepaid stock	11,700 00	Loans on mortgages and stock	15,075 00
Interest received	455 95	Interest paid	8 94
Fines received	40	Dues repaid — installment stock	406 19
Loans repaid	200 00	Paid-up and prepaid stock and dividends	39 50
Overdrafts and bills payable	600 00	Other expenses	255 81
All other receipts	74 05	Balance on hand and in bank	1,444 94
Total receipts	$17,830 38	Total disbursements	$17,830 38

INSTALLMENT STOCK, WITH AGE, VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Serial No.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
12	$6 00	$6 13	$6 00
6	3 00	3 04	3 00

No. 51—PASADENA.

MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated July 26, 1892.)

R. H. PINNEY, Secretary. PETER OSBORN, President.

Fiscal year ends June 30, 1899.

No. of series, 14. No. of shares, 1,897½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$57,405 00	Installment stock—dues	$29,520 00
Arrearages		1,024 75	Paid-up and prepaid stock	13,200 00
On shares	$558 50		Earnings apportioned	11,388 56
On interest	215 67		Advance payments	597 35
On premiums	180 63		Reserve and undivided profits	400 94
On fines, etc.	69 95		Other liabilities	6,500 00
Cash on hand and in bank		2,920 02		
Other assets		257 08		
Total assets		$61,606 85	Total liabilities	$61,606 85

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,558 40	Loans on mortgages and stock	$13,060 00
Installment stock—dues	9,695 85	Interest paid	227 69
Paid-up and prepaid stock	3,050 00	Dues repaid — installment stock	8,069 00
Interest received	2,888 72	Profits repaid—installment stock	1,346 82
Premiums received	2,470 08	Paid-up and prepaid stock, and dividends	272 32
Fines received	96 18	Salaries	330 00
Fees received	60 70	Other expenses	742 00
Loans repaid	6,265 00	All other disbursements	117 08
		Balance on hand and in bank	2,920 02
Total receipts	$27,084 93	Total disbursements	$27,084 93

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	220	$42 00	$62 74	$60 67
2	54	39 00	56 59	52 19
3	83	36 00	50 72	47 04
4	62	33 00	45 07	40 24
5	25	30 00	39 79	35 87
6	59	27 00	34 73	30 86
7	20	24 00	29 97	26 98
8	71	21 00	25 47	23 23
9	105	18 00	21 25	19 62
10	144	15 00	17 19	16 09
11	71	12 00	13 40	12 70
12	187	9 00	9 81	9 40
13	184	6 00	6 38	6 19
14	379	3 00	3 07	3 03

No. 52—PETALUMA.

PETALUMA MUTUAL LOAN ASSOCIATION.

(Incorporated September, 1889.)

LYMAN GREEN, Secretary. F. A. MEYER, President.

Fiscal year ends September 30, 1899.

No. of series, 11. No. of shares, 633½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$64,845 00	Installment stock—dues	$52,998 00
Arrearages		2,895 95	Earnings apportioned	15,634 54
On shares	$1,054 00		Overdrafts and bills payable	500 00
On interest	999 50		Reserve and undivided profits	36 27
On premiums	301 55			
On fines, etc.	540 90			
Cash on hand and in bank		177 86		
Real estate owned		1,250 00		
Total assets		$69,168 81	Total liabilities	$69,168 81

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$6,288 75	Overdrafts and bills payable	$7,000 00
Installment stock—dues	8,010 30	Loans on mortgages and stock	3,420 00
Interest received	3,938 60	Interest paid	334 15
Premiums received	531 55	Dues repaid — installment stock	11,922 00
Fines received	72 65	Profits repaid — installment stock	4,321 47
Loans repaid	1,200 00	Salaries	420 00
Overdrafts and bills payable	7,500 00	Taxes	774 22
All other receipts	1,060 00	Other expenses	92 15
		All other disbursements	140 00
		Balance on hand and in bank	177 86
Total receipts	$28,601 85	Total disbursements	$28,601 85

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	74	$120 00	$175 42	$175 42
2	25	114 00	160 70	160 70
3	112	108 00	145 48	145 48
4	122	96 00	122 08	121 43
5	94	84 00	102 47	101 54
6	49½	72 00	85 00	83 70
7	25	60 00	68 83	67 70
8	24	48 00	53 40	52 32
9	78	36 00	38 97	38 23
10	15	24 00	25 31	24 92
11	15	12 00	12 34	12 22

No. 53—PLEASANTON.

PLEASANTON MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated March 1, 1895.)

T. H. SILVER, Secretary. WM. H. COPE, President.

Fiscal year ends March 21, 1900.

No. of series, 8. No. of shares, 252.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$12,950 00	Installment stock—dues	$10,518 00
Cash on hand and in bank	128 69	Earnings apportioned	1,955 35
		Overdrafts and bills payable	600 00
		Other liabilities	5 34
Total assets	$13,078 69	Total liabilities	$13,078 69

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$182 57	Overdrafts and bills payable	$3,400 00
Installment stock—dues	2,934 00	Loans on mortgages and stock	1,400 00
Interest received	777 00	Interest paid	206 25
Premiums received	396 00	Salaries	36 00
Fees received	17 80	Taxes	115 83
Overdrafts and bills payable	1,000 00	Other expenses	20 60
		Balance on hand and in bank	128 69
Total receipts	$5,307 37	Total disbursements	$5,307 37

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	115	$60 00	$73 17	Dues and profits at option of the Board of Directors.
2	11	48 00	56 82	
3	23	42 00	48 48	
4	21	36 00	40 71	
6	32	24 00	26 09	
7	15	18 00	19 11	
8	20	12 00	12 51	
9	15	6 00	6 14	

No. 54—POMONA.

MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated December 24, 1892.)

C. I. LORBEER, Secretary. J. T. BRADY, President.

Fiscal year ends December 31, 1899.

No. of series, 14. No. of shares, 1,536.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$41,075 00	Installment stock—dues	$33,255 00
Arrearages		202 50	Earnings apportioned	8,352 68
On shares	$77 00		Advance payments	157 50
On interest	94 30		Reserve and undivided profits	3 12
On premiums	12 65		Other liabilities	960 00
On fines, etc.	18 55			
Cash on hand and in bank		1,314 85		
Other assets		135 95		
Total assets		$42,728 30	Total liabilities	$42,728 30

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,804 72	Loans on mortgages and stock	$18,060 00
Installment stock—dues	9,298 50	Interest paid	11 50
Interest received	2,948 05	Dues repaid — installment stock	2,457 00
Premiums received	610 30	Profits repaid — installment stock	321 76
Fines received	49 05	Salaries	700 00
Fees received	43 90	Taxes	547 93
Loans repaid	6,750 00	Other expenses	91 48
		Balance on hand and in bank	1,314 85
Total receipts	$23,504 52	Total disbursements	$23,504 52

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	169	$42 00	$58 16	$54 12
2	99	39 00	52 50	47 44
3	130	36 00	47 15	43 10
4	28	33 00	42 09	38 93
5	128	30 00	37 29	34 84
6	77	27 00	32 76	30 89
7	75	24 00	28 38	27 04
8	79	21 00	24 22	23 31
9	129	18 00	20 26	19 67
10	84	15 00	16 50	16 15
11	147	12 00	12 91	12 73
12	59	9 00	9 48	9 41
13	147	6 00	6 21	6 18
14	185	3 00	3 06	3 05

No. 55—REDWOOD CITY.

SAN MATEO COUNTY BUILDING AND LOAN ASSOCIATION.

(Incorporated May 8, 1890.)

GEO. W. LOVIE, Secretary. P. P. CHAMBERLAIN, President.

Fiscal year ends May 31, 1900.

No. of series, 30. No. of shares, 2,460.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$143,756 85	Installment stock—dues	$126,612 00
Arrearages		4,744 05	Earnings apportioned	43,446 67
On shares	$2,928 00		Advance payments	309 25
On interest	1,530 30		Reserve and undivided profits	1,426 11
On premiums	285 75		Other liabilities	3,000 00
Cash on hand and in bank		8,500 70		
Real estate owned		11,298 73		
Other assets		6,493 70		
Total assets		$174,794 03	Total liabilities	$174,794 03

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$12,046 09	Loans on mortgages and stock	$30,579 57
Installment stock—dues	29,684 00	Dues repaid — installment stock	33,114 00
Interest received	11,177 24	Profits repaid — installment stock	15,679 50
Premiums received	4,356 55	Salaries	1,085 00
Fines received	151 10	Taxes	2,599 55
Fees received	103 65	Other expenses	527 19
Loans repaid	40,781 65	All other disbursements	14,649 58
All other receipts	8,434 81	Balance on hand and in bank	8,500 70
Total receipts	$106,735 09	Total disbursements	$106,735 09

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
120	$120 00	$197 20	$197 20
108	108 00	168 04	162 04
96	96 00	142 13	135 22
84	84 00	117 92	111 14
72	72 00	95 92	89 94
60	60 00	75 92	71 15
48	48 00	57 80	54 37
36	36 00	41 15	39 33
24	24 00	26 18	25 00
18	18 00	19 20	18 57
12	12 00	12 60	12 26
6	6 00	6 15	6 00

No. 56—SACRAMENTO.

GERMANIA BUILDING AND LOAN ASSOCIATION.

(Incorporated December 31, 1872.)

H. J. GOETHE, Secretary. CHAS. SCHMIDT, President.

Fiscal year ends December 31, 1899.

No. of series, 9. No. of shares, 3,794.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$233,868 15	Installment stock—dues	$274,704 00
Arrearages	3,708 59	Paid-up and prepaid stock	27,200 00
On shares $2,102 00		Earnings apportioned	84,698 63
On interest 1,606 59		Advance payments	396 35
Cash on hand and in bank	1,927 93	Overdrafts and bills payable	6,000 00
Real estate owned	168,974 00	Reserve and undivided profits	17,597 16
Other assets	2,117 47		
Total assets	$410,596 14	Total liabilities	$410,596 14

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$16,186 23	Overdrafts and bills payable	$44,000 00
Installment stock—dues	49,448 00	Loans on mortgages and stock	16,695 00
Interest received	37,915 97	Interest paid	2,478 68
Fines received	1 00	Dues repaid — installment stock	162,003 00
Fees received	8 50	Profits repaid — installment stock	45,789 80
Loans repaid	179,133 70	Salaries	3,000 00
Overdrafts and bills payable	50,000 00	Taxes	10,497 90
All other receipts	20,341 73	Other expenses	1,694 37
		All other disbursements	64,948 45
		Balance on hand and in bank	1,927 93
Total receipts	$353,035 13	Total disbursements	$353,035 13

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
6	1,106	$108 00	$160 20	Dues and interest as fixed by Board of Directors.
7	519	96 00	118 95	
8	380	84 00	100 65	
9	406	72 00	83 55	
10	267	60 00	67 53	
11	273	48 00	52 59	
12	207	36 00	38 52	
13	142	24 00	25 10	
14	358	12 00	12 27	
5 full paid	136			

No. 57—SACRAMENTO.

SACRAMENTO BUILDING AND LOAN ASSOCIATION.

(Incorporated August 26, 1874.)

FRANK HICKMAN, Secretary. DANIEL FLINT, Vice-President.

Fiscal year ends August 31, 1899.

No. of series, 12. No. of shares, 2,222.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$169,995 66	Installment stock—dues	$157,494 00
Arrearages	6,236 45	Earnings apportioned	49,901 12
On shares $2,380 00		Reserve and undivided profits	7,319 97
On interest 3,715 75		Other liabilities	42 30
On fines, etc. 140 70			
Cash on hand and in bank	5,860 48		
Real estate owned	32,327 32		
Other assets	337 48		
Total assets	$214,757 39	Total liabilities	$214,757 39

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,035 34	Loans on mortgages and stock	$16,812 31
Installment stock—dues	27,554 00	Interest paid	1,353 04
Interest received	18,400 82	Dues repaid — installment stock	41,032 00
Fines received	162 10	Profits repaid — installment stock	13,060 14
Fees received	10 00	Salaries	1,200 00
Loans repaid	51,181 20	Taxes	5,402 92
		Other expenses	223 19
		All other disbursements	15,399 38
		Balance on hand and in bank	5,860 48
Total receipts	$100,343 46	Total disbursements	$100,343 46

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
11	70	$135 00	$200 00	$200 00
12	206	132 00	195 83	186 04
13	136	120 00	171 45	162 88
14	192	108 00	148 56	147 14
15	159	96 00	127 25	120 90
16	234	84 00	107 33	101 97
17	84	72 00	88 68	84 20
18	173	60 00	71 21	67 65
19	296	48 00	54 95	52 21
20	314	36 00	39 77	37 79
21	220	24 00	25 61	24 00
22	138	12 00	12 39	12 00

No. 58—SALINAS.

SALINAS MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated September 2, 1897.)

W. H. CLARK, Secretary. J. D. CARR, President.

Fiscal year ends September 1, 1899.

No. of series, 2. No. of shares, 870.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$9,650 00	Installment stock—dues	$9,865 00
Arrearages		50 54	Earnings apportioned	471 50
On shares	$20 00		Reserve and undivided profits	9 63
On interest	19 60		Other liabilities	217 00
On fines, etc.	10 94			
Cash on hand and in bank		721 29		
Other assets		141 30		
Total assets		$10,563 13	Total liabilities	$10,563 13

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$418 53	Overdrafts and bills payable	$895 00
Installment stock—dues	5,677 50	Loans on mortgages and stock	5,233 00
Interest received	681 45	Interest paid	36 60
Fines received	13 46	Dues repaid — installment stock	1,292 50
Fees received	11 30	Salaries	240 00
Loans repaid	1,700 00	Taxes	90 85
All other receipts	39 70	Other expenses	32 70
		Balance on hand and in bank	721 29
Total receipts	$8,541 94	Total disbursements	$8,541 94

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	775	$12 00	$12 59	$12 00
2	95	6 00	6 15	6 00

No. 59—SAN BERNARDINO.

SANTA FE BUILDING AND LOAN ASSOCIATION.

(Incorporated January 8, 1890.)

JOHN FLAGG, Secretary. J. F. PARKER, President.

Fiscal year ends December 31, 1899.

No. of series, 10. No. of shares, 1,477.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$77,335 00	Installment stock—dues	$54,007 00
Arrearages		826 00	Paid-up and prepaid stock	12,300 00
On shares	$232 00		Earnings apportioned	14,120 48
On interest	495 80		Reserve and undivided profits	122 45
On fines, etc.	98 20		Other liabilities	93 75
Cash on hand and in bank		2,332 68		
Other assets		150 00		
Total assets		$80,643 68	Total liabilities	$80,643 68

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,455 95	Loans on mortgages and stock	$23,181 00
Installment stock—dues	17,438 70	Interest paid	796 75
Paid-up and prepaid stock	1,700 00	Dues repaid — installment stock	15,085 70
Interest received	7,924 15	Profits repaid — installment stock	6,526 38
Fines received	139 95	Paid-up and prepaid stock	1,600 00
Loans repaid	22,235 00	Salaries	500 00
		Taxes	1,719 09
		Other expenses	152 15
		Balance on hand and in bank	2,332 68
Total receipts	$51,893 75	Total disbursements	$51,893 75

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Withdrawal Value.
1	10	$120 00	
2	50	108 00	
3	45	96 00	
4	49	84 00	
5	112	72 00	Dues
6	190	60 00	and 6%.
7	138	48 00	
8	205	36 00	
9	317	24 00	
10	361	12 00	

No. 60—SAN DIEGO.

SAN DIEGO BUILDING AND LOAN ASSOCIATION.

(Incorporated July 14, 1885.)

THEO. FINTZELBERG, Secretary. A. BLOCHMAN, President.

Fiscal year ends July 31, 1899.

No. of series, 9. No. of shares, 3,928.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$139,970 00	Installment stock—dues	$128,354 00
Arrearages		1,796 85	Earnings apportioned	23,415 36
On shares	$627 00		Advance payments	5,006 28
On interest	1,169 85		Reserve and undivided profits	6,083 29
Cash on hand and in bank		6,130 18	Other liabilities	434 10
Real estate owned		11,500 00		
Other assets		3,896 00		
Total assets		$163,293 03	Total liabilities	$163,293 03

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$9,145 59	Loans on mortgages and stock	$17,450 00
Installment stock—dues	57,003 00	Interest paid	225 32
Interest received	13,971 64	Dues repaid — installment stock	66,301 00
Premiums received	1,617 00	Profits repaid — installment stock	14,561 06
Fines received	293 06	Salaries	1,200 00
Fees received	172 60	Taxes	3,458 70
Loans repaid	27,135 00	Other expenses	372 97
All other receipts	4,229 85	All other disbursements	3,868 51
		Balance on hand and in bank	6,130 18
Total receipts	$113,567 74	Total disbursements	$113,567 74

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	106	$110 00	$167 34	$139 97
5	68	95 00	132 98	117 32
6	35	83 00	109 50	100 01
7	65	71 00	89 24	83 42
8	196	59 00	71 34	67 55
9	653	47 00	54 40	52 40
10	831	35 00	39 04	37 97
11	805	23 00	24 80	24 26
12	1,169	11 00	11 50	11 27

No. 61—SAN DIEGO.

SILVER GATE BUILDING AND LOAN ASSOCIATION.

(Incorporated May 22, 1890.)

J. D. Wood, Secretary. L. F. Doolittle, President.

Fiscal year ends May 31, 1900.

No. of series, 9. No. of shares, 592.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$21,750 00	Installment stock—dues	$19,934 00
Arrearages		150 60	Earnings apportioned	4,392 98
On shares	$48 00		Advance payments	234 85
On interest	95 40		Overdrafts and bills payable	1,000 00
On fines, etc.	7 20		Reserve and undivided profits	83 89
Cash on hand and in bank		855 12		
Real estate owned		2,860 00		
Other assets		30 00		
Total assets		$25,645 72	Total liabilities	$25,645 72

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,765 82	Loans on mortgages and stock	$8,760 00
Installment stock—dues	6,907 00	Interest paid on paid-up stock	200 00
Interest received	2,350 54	Dues repaid — installment stock	7,606 00
Premiums received	63 00	Profits repaid — installment stock	3,960 19
Fines received	54 35	Paid-up and prepaid stock	1,000 00
Fees received	60 60	Salaries	300 00
Loans repaid	7,824 00	Taxes	418 62
Overdrafts and bills payable	1,000 00	Other expenses	57 43
All other receipts	1,257 05	All other disbursements	125 00
		Balance on hand and in bank	855 12
Total receipts	$23,282 36	Total disbursements	$23,282 36

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	52	$89 00	$124 05	$105 50
3	35	72 00	92 86	82 80
4	48	60 00	73 33	67 50
5	26	48 00	56 21	52 80
6	127	39 00	44 57	42 17
7	34	33 00	37 13	35 26
8	27	21 00	22 76	21 92
9	93	12 00	12 55	12 30
10	150	6 00	6 27	6 15

No. 62—SAN FRANCISCO.

ACME BUILDING AND LOAN ASSOCIATION.

(Incorporated March 14, 1891.)

OSCAR HEYMAN, Secretary. D. DAVIS, President.

Fiscal year ends February 15, 1900.

No. of series, 14. No. of shares, 648½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$40,924 00	Installment stock—dues	$42,261 00
Arrearages		953 57	Earnings apportioned	9,475 54
On shares	$488 50		Overdrafts and bills payable	4,826 94
On interest	327 17		Reserve and undivided profits	343 02
On premiums	137 90		Other liabilities	769 75
Cash on hand and in bank		30		
Real estate owned		15,668 38		
Other assets		130 00		
Total assets		$57,676 25	Total liabilities	$57,676 25

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,317 44	Loans on mortgages and stock	$19,125 00
Installment stock—dues	7,490 00	Interest paid	202 68
Interest received	2,459 17	Dues repaid — installment stock	4,829 50
Premiums received	663 85	Profits repaid — installment stock	454 67
Fines received	2 50	Salaries	600 00
Fees received	16 63	Taxes	452 60
Loans repaid	7,751 00	Other expenses	204 97
Overdrafts and bills payable	4,826 94	All other disbursements	115 01
All other receipts	1,457 20	Balance on hand and in bank	30
Total receipts	$25,984 73	Total disbursements	$25,984 73

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	155	$108 00	$137 82	$122 90
2	120	101 00	126 36	113 68
3	30	96 00	118 27	107 14
4	15	90 00	109 26	99 63
5	10	84 00	100 53	92 26
8	10	66 00	75 65	70 83
9	10	60 00	68 17	64 08
12	53½	42 00	46 01	44 00
13	49½	36 00	39 00	37 50
14	27	30 00	32 01	31 00
15	37	24 00	25 29	24 64
16	8	18 00	18 80	18 40
17	79	12 00	12 39	12 19
18	45	6 00	6 20	6 10

No. 63—SAN FRANCISCO.

ÆTNA MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated May 18, 1893.)

N. SCHLESINGER, Secretary. AUGUST DRUCKER, President.

Fiscal year ends May 31, 1900.

No. of series, 7. No. of shares, 731.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$42,000 00	Installment stock—dues	$41,532 00
Arrearages		7,031 89	Earnings apportioned	9,043 55
On shares	$3,469 00		Overdrafts and bills payable	7,325 25
On interest	3,562 89			
Real estate owned		8,752 96		
Other assets		115 95		
Total assets		$57,900 80	Total liabilities	$57,900 80

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$7,808 00	Overdrafts and bills payable	$2,191 78
Interest received	1,869 73	Loans on mortgages and stock	7,400 00
Premiums received	150 00	Interest paid	679 50
Fees received	5 70	Dues repaid — installment stock	7,300 00
Loans repaid	5,400 00	Profits repaid — installment stock	919 22
Overdrafts and bills payable	7,325 25	Salaries	1,032 00
All other receipts	413 19	Taxes	611 33
		Other expenses	91 91
		All other disbursements	2,746 13
Total receipts	$22,971 87	Total disbursements	$22,971 87

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	290	$84 00	$106 33	$95 16
2	39	72 00	88 44	78 58
3	56	60 00	71 44	63 43
4	92	48 00	55 35	49 47
5	83	36 00	40 16	36 42
6	129	24 00	25 87	24 09
7	42	12 00	12 48	12 00

No. 64—SAN FRANCISCO.

ALLIANCE BUILDING AND LOAN ASSOCIATION.

(Incorporated October 14, 1890.)

JULIUS CALMANN, Secretary. G. H. UMBSEN, President.

Fiscal year ends October 17, 1899.

No. of series, 13. No. of shares, 551.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$35,020 00	Installment stock—dues	$43,110 00
Arrearages		497 00	Earnings apportioned	10,637 26
On shares	$227 00		Advance payments	469 20
On interest	189 00		Reserve and undivided profits	2,003 69
On premiums	81 00		Unearned premiums	559 36
Cash on hand and in bank		7,045 86		
Real estate owned		14,106 65		
Other assets		110 00		
Total assets		$56,779 51	Total liabilities	$56,779 51

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$22 42	Overdrafts and bills payable	$4,996 92
Installment stock—dues	6,430 00	Loans on mortgages and stock	120 00
Interest received	2,409 80	Interest paid	94 49
Premiums received	779 50	Dues repaid — installment stock	3,008 00
Fines received	22 50	Profits repaid — installment stock	300 50
Fees received	3 20	Salaries	997 50
Loans repaid	6,300 00	Taxes	568 43
All other receipts	4,819 05	Other expenses	260 57
		All other disbursements	3,394 20
		Balance on hand and in bank	7,045 86
Total receipts	$20,786 47	Total disbursements	$20,786 47

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	295	$108 00	$139 21	$131 40
2	10	102 00	129 12	115 56
5	10	84 00	101 30	92 65
6	14	78 00	92 36	85 18
8	25	66 00	75 20	70 60
9	13	60 00	67 47	63 73
10	13	54 00	60 16	57 08
11	15	48 00	52 50	50 25
12	8	42 00	45 70	43 85
13	55	36 00	38 73	37 36
14	53	30 00	31 91	30 95
16	10	18 00	19 02	18 51
17	30	12 00	12 64	12 32

No. 65—SAN FRANCISCO.

ATLAS BUILDING AND LOAN ASSOCIATION.

(Incorporated October 14, 1890.)

N. SCHLESINGER, Secretary. CHAS. HARRIS, President.

Fiscal year ends September 30, 1899.

No. of series, 9. No. of shares, 839.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$43,700 00	Installment stock—dues	$69,204 00
Arrearages	10,805 77	Earnings apportioned	6,397 33
On shares $5,742 00		Overdrafts and bills payable	1,791 65
On interest 5,603 77		Reserve and undivided profits	16,927 12
Real estate owned	39,725 33		
Other assets	89 00		
Total assets	$94,320 10	Total liabilities	$94,320 10

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$6,593 03	Loans on mortgages and stock	$11,800 00
Installment stock—dues	12,276 00	Interest paid	206 04
Interest received	2,364 32	Dues repaid — installment stock	27,978 00
Fees received	5 90	Profits repaid — installment stock	2,497 44
Loans repaid	28,800 00	Salaries	1,460 00
Overdrafts and bills payable	1,791 65	Taxes	907 84
All other receipts	707 00	Other expenses	155 62
		All other disbursements	7,532 96
Total receipts	$52,537 90	Total disbursements	$52,537 90

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	305	$108 00	$119 64	$113 82
2	140	96 00	105 21	100 14
3	114	84 00	91 06	86 82
4	68	72 00	77 20	74 17
5	71	60 00	63 62	61 09
6	26	48 00	50 32	48 58
7	26	36 00	37 31	36 26
8	70	24 00	24 59	24 09
9	19	12 00	12 13	12 02

No. 66—SAN FRANCISCO.

ALTA BUILDING AND LOAN ASSOCIATION.

(Incorporated February, 1891.)

SOL. J. LEVY, Secretary. JULIUS JACOBS, President.

Fiscal year ends February 28, 1900.

No. of series, 7. No. of shares, 282.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$25,850 00	Installment stock—dues	$28,356 00
Arrearages		774 42	Earnings apportioned	2,913 95
On shares	$444 00		Reserve and undivided profits	6,272 51
On interest	263 42		Unearned premiums	2,874 46
On premiums	67 00		Other liabilities	60 00
Cash on hand and in bank		8,217 85		
Real estate owned		4,200 00		
Other assets		1,434 65		
Total assets		$40,476 92	Total liabilities	$40,476 92

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,495 90	Dues repaid — installment stock	$8,130 00
Installment stock—dues	3,875 00	Profits repaid — installment stock	82 50
Interest received	1,461 12	Salaries	625 00
Premiums received	140 00	Taxes	377 56
Fines received	18 00	Other expenses	44 50
Loans repaid	6,000 00	All other disbursements	311 10
All other receipts	3,798 49	Balance on hand and in bank	8,217 85
Total receipts	$17,788 51	Total disbursements	$17,788 51

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	192	$108 00	$120 40	$110 00
2	45	102 00	111 70	103 00
3	5	96 00	103 19	96 00
6	15	78 00	80 50	78 00
7	10	72 00	73 68	72 00
10	10	54 00	54 64	54 00
12	5	24 00	24 00	24 00

No. 67—SAN FRANCISCO.

ARGONAUT MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated January 31, 1891.)

E. GUNZBURGER, Secretary. GEORGE W. DIXON, President.

Fiscal year ends February 10, 1900.

No. of series, 9. No. of shares, 770.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$40,210 00	Installment stock—dues	$48,672 00
Arrearages		2,518 70	Earnings apportioned	12,217 97
On shares	$880 00		Advance payments	224 75
On interest	1,209 60		Reserve and undivided profits	2,414 04
On premiums	429 10		Other liabilities	180 00
Cash on hand and in bank		5,030 68		
Real estate owned		15,923 00		
Other assets		26 38		
Total assets		$63,708 76	Total liabilities	$63,708 76

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,396 20	Loans on mortgages and stock	$7,800 00
Installment stock—dues	8,663 00	Interest paid	4 94
Interest received	2,491 70	Dues repaid — installment stock	7,863 00
Premiums received	1,100 95	Profits repaid — installment stock	1,166 66
Fines received	8 20	Salaries	1,044 00
Loans repaid	9,765 00	Taxes	735 55
All other receipts	1,459 50	Other expenses	53 81
		All other disbursements	2,185 91
		Balance on hand and in bank	5,030 68
Total receipts	$25,884 55	Total disbursements	$25,884 55

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	149	$108 00	$142 25	$128 55
2	154	96 00	123 09	109 54
3	51	84 00	104 77	94 38
4	28	72 00	87 29	79 65
5	73	60 00	70 64	64 25
6	14	48 00	54 84	50 05
7	112	36 00	39 87	37 16
8	60	24 00	25 75	24 52
9	81	12 00	12 55	12 17

No. 68—SAN FRANCISCO.

BAY CITY BUILDING AND LOAN ASSOCIATION.

(Incorporated May 9, 1889.)

E. Gunzburger, Secretary. W. H. Bremer, President.

Fiscal year ends May 27, 1900.

No. of series, 10. No. of shares, 691.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$60,650 00	Installment stock—dues	$51,192 00
Arrearages		4,158 65	Earnings apportioned	16,236 41
On shares	$1,880 00		Advance payments	200 00
On interest	1,469 05		Overdrafts and bills payable	1,919 20
On premiums	809 60		Reserve and undivided profits	2,721 87
Real estate owned		8,772 68	Other liabilities	1,426 60
Other assets		114 75		
Total assets		$73,696 08	Total liabilities	$73,696 08

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$5,057 08	Loans on mortgages and stock	$8,900 00
Installment stock—dues	10,001 00	Dues repaid — installment stock	25,074 00
Interest received	3,698 10	Profits repaid — installment stock	7,834 45
Premiums received	1,271 30	Salaries	1,297 50
Fees received	9 60	Taxes	726 66
Loans repaid	23,300 00	Other expenses	277 25
Overdrafts and bills payable	1,919 20	All other disbursements	2,918 94
All other receipts	1,772 52		
Total receipts	$47,028 80	Total disbursements	$47,028 80

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	203	$132 00	$183 81	$176 04
2	46	120 00	162 85	150 00
3	67	108 00	142 74	128 85
4	5	96 00	123 48	112 48
6	5	72 00	87 51	81 31
7	27	60 00	70 80	65 40
8	51	48 00	54 94	51 47
9	81	36 00	39 93	37 96
10	112	24 00	25 77	24 88
11	94	12 00	12 46	12 23

No. 69—SAN FRANCISCO.

CALIFORNIA MUTUAL SAVINGS FUND, LOAN, AND BUILDING ASSOCIATION.

(Incorporated March 26, 1887.)

WILLIAM E. LUTZ, Secretary. EDWIN L. HEAD, President.

Fiscal year ends March 31, 1900.

No. of series, 21. No. of shares, 737.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$62,390 00	Installment stock—dues	$43,764 00
Arrearages		2,124 10	Earnings apportioned	14,639 45
On shares	$1,187 00		Advance payments	36 00
On interest	690 30		Overdrafts and bills payable	9,059 15
On premiums	246 80		Reserve and undivided profits	2,004 05
Real estate owned		8,900 00	Unearned premiums	3,554 43
Other assets		10 00	Other liabilities	367 02
Total assets		$73,424 10	Total liabilities	$73,424 10

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$9,496 00	Overdrafts and bills payable	$8,876 26
Interest received	4,708 65	Loans on mortgages and stock	2,800 00
Premiums received	1,257 00	Interest paid	587 38
Fines received	62 65	Dues repaid — installment stock	15,004 00
Fees received	10 90	Profits repaid — installment stock	7,200 23
Loans repaid	14,585 00	Salaries	815 00
Overdrafts and bills payable	6,059 15	Taxes	709 89
All other receipts	1,413 25	Other expenses	80 32
		All other disbursements	1,519 52
Total receipts	$37,592 60	Total disbursements	$37,592 60

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
126	$126 00	$198 23	
120	120 00	183 69	
108	108 00	156 70	
96	96 00	132 24	
84	84 00	110 22	
72	72 00	90 29	Dues and 50% to 90% of profits.
60	60 00	72 24	
48	48 00	55 77	
36	36 00	40 46	
24	24 00	26 13	
12	12 00	12 56	
6	6 00	6 15	

No. 70—SAN FRANCISCO.

CAPITAL BUILDING AND LOAN ASSOCIATION.

(Incorporated June, 1890.)

W. H. DAVIS, Secretary. FRED W. BOOLE, President.

Fiscal year ends May 31, 1900.

No. of series, 27. No. of shares, 1,050.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$55,840 00	Installment stock—dues	$42,599 00
Arrearages		1,313 92	Earnings apportioned	15,759 13
On shares	$663 00		Advance payments	890 00
On interest	465 17		Overdrafts and bills payable	7,514 01
On premiums	185 75		Reserve and undivided profits	2,534 95
Real estate owned		12,076 97		
Other assets		66 20		
Total assets		$69,297 09	Total liabilities	$69,297 09

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$12,323 00	Overdrafts and bills payable	$11,015 93
Interest received	4,627 87	Loans on mortgages and stock	14,590 00
Premiums received	1,761 09	Interest paid	826 63
Fines received	56 69	Dues repaid — installment stock	7,168 00
Fees received	24 40	Profits repaid — installment stock	1,179 19
Loans repaid	8,540 00	Salaries	1,250 00
Overdrafts and bills payable	7,514 01	Taxes	618 46
All other receipts	3,225 61	Other expenses	103 30
		All other disbursements	1,321 16
Total receipts	$38,072 67	Total disbursements	$38,072 67

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
120	$120 00	$190 19	$156 10
111	111 00	167 29	142 08
96	96 00	133 84	119 28
87	87 00	116 28	106 15
72	72 00	89 91	85 14
63	63 00	75 67	73 08
48	48 00	54 60	53 88
42	42 00	46 90	46 51
30	30 00	32 41	32 32
24	24 00	25 44	25 44
18	18 00	18 68	18 68
12	12 00	12 26	12 26
6	6 00	6 10	6 10

No. 71—SAN FRANCISCO.

CITY BUILDING AND LOAN ASSOCIATION.

(Incorporated March 26, 1891.)

J. M. Ellis, Secretary. Wm. H. Bremer, President.

Fiscal year ends March 31, 1900.

No. of series, 9. No. of shares, 851½.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$47,050 00	Installment stock—dues	$59,124 00
Arrearages		1,063 20	Earnings apportioned	15,642 06
On shares	$653 00		Reserve and undivided profits	3,527 44
On interest	403 20			
On premiums	7 00			
Cash on hand and in bank		7,608 53		
Real estate owned		22,523 77		
Other assets		48 00		
Total assets		$78,293 50	Total liabilities	$78,293 50

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$194 55	Overdrafts and bills payable	$3,475 82
Installment stock—dues	10,529 00	Loans on mortgages and stock	10,650 00
Interest received	3,667 25	Interest paid	239 97
Premiums received	515 50	Dues repaid — installment stock	16,252 80
Fees received	5 50	Profits repaid — installment stock	2,189 32
Loans repaid	22,150 00	Salaries	1,280 50
All other receipts	8,067 00	Taxes	513 90
		Other expenses	115 93
		All other disbursements	2,802 03
		Balance on hand and in bank	7,608 53
Total receipts	$45,128 80	Total disbursements	$45,128 80

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	270	$108 00	$144 91	
2	75	102 00	134 11	
4	43	84 00	103 55	
5	84	72 00	85 81	Dues and 65% to 75% of profits.
6	53	60 00	68 62	
7	65	48 00	53 36	
8	81½	36 00	39 14	
9	105	24 00	25 45	
10	75	12 00	12 72	

No. 72—SAN FRANCISCO.

CITIZENS BUILDING AND LOAN ASSOCIATION.

(Incorporated January 14, 1885.)

FREMONT WOOD, Secretary. T. M. GARDINER, President.

Fiscal year ends February 28, 1900.

No. of series, 40. No. of shares, 7,302.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$382,688 57	Installment stock—dues	$340,005 00
Arrearages		15,822 10	Earnings apportioned	79,712 34
On shares	$5,414 00		Advance payments	1,203 00
On interest	5,987 65		Overdrafts and bills payable	31,700 00
On premiums	2,628 30		Reserve and undivided profits	16,840 08
On fines, etc.	1,792 15		Other liabilities	2,726 37
Cash on hand and in bank		9,731 95		
Real estate owned		63,341 32		
Other assets		602 85		
Total assets		$472,186 79	Total liabilities	$472,186 79

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$23,795 21	Overdrafts and bills payable	$97,000 00
Installment stock—dues	98,633 00	Loans on mortgages and stock	49,210 15
Interest received	31,756 52	Interest paid	1,865 21
Premiums received	12,896 87	Dues repaid — installment stock	188,530 00
Fines received	981 85	Profits repaid — installment stock	79,706 38
Fees received	116 15	Salaries	2,412 00
Loans repaid	149,105 00	Taxes	7,100 77
Overdrafts and bills payable	128,700 00	Other expenses	2,319 62
All other receipts	13,068 28	All other disbursements	21,176 80
		Balance on hand and in bank	9,731 95
Total receipts	$459,052 88	Total disbursements	$359,052 88

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
120	$120 00	$186 50	$164 43
108	108 00	158 26	143 25
96	96 00	133 67	123 29
84	84 00	111 16	104 48
72	72 00	90 49	86 76
60	60 00	71 99	69 15
48	48 00	55 62	53 88
36	36 00	40 21	39 33
24	24 00	25 87	25 50
12	12 00	12 53	12 39
6	6 00	6 14	6 10

No. 73—SAN FRANCISCO.

COLUMBIA BUILDING AND LOAN ASSOCIATION.

(Incorporated May 2, 1890.)

E. GUNZBURGER, Secretary. S. ZEMANSKY, President.

Fiscal year ends May 9, 1900.

No. of series, 6. No. of shares, 468.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$17,200 00	Installment stock—dues	$45,000 00
Arrearages		14,655 75	Overdrafts and bills payable	4,117 61
On shares	$13,971 00		Reserve and undivided profits	4,241 49
On interest	341 25			
On premiums	343 50			
Real estate owned		21,503 35		
Total assets		$53,359 10	Total liabilities	$53,359 10

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$2,427 00	Overdrafts and bills payable	$3,552 82
Interest received	1,133 55	Loans on mortgages and stock	500 00
Premiums received	197 25	Interest paid	394 72
Loans repaid	300 00	Dues repaid — installment stock	1,072 50
Overdrafts and bills payable	1,617 61	Salaries	780 00
All other receipts	1,443 60	Taxes	331 00
		Other expenses	152 52
		All other disbursements	335 45
Total receipts	$7,119 01	Total disbursements	$7,119 01

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	111	$120 00	$120 00	$120 00
2	25	108 00	108 00	108 00
3	101	96 00	96 00	96 00
4	54	90 00	90 00	90 00
5	140	84 00	84 00	84 00
6	37	72 00	72 00	72 00

No. 74—SAN FRANCISCO.

COMMERCIAL BUILDING AND LOAN ASSOCIATION.

(Incorporated December 21, 1886.)

CHARLES K. CLARK, Secretary. G. S. GRAHAM, President.

Fiscal year ends December 31, 1899.

No. of series, 28. No. of shares, 1,293.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$81,290 00	Installment stock—dues	$75,327 00
Arrearages		4,597 15	Earnings apportioned	24,489 99
On shares	$1,483 00		Advance payments	976 00
On interest	2,402 05		Reserve and undivided profits	3,347 61
On premiums	176 25		Other liabilities	3,996 90
On fines, etc.	535 85			
Cash on hand and in bank		2 62		
Real estate owned		21,771 62		
Other assets		476 11		
Total assets		$108,137 50	Total liabilities	$108,137 50

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,811 39	Loans on mortgages and stock	$19,915 00
Installment stock—dues	16,517 00	Interest paid	426 97
Interest received	7,612 75	Dues repaid — installment stock	15,541 00
Premiums received	754 45	Profits repaid — installment stock	4,531 80
Fines received	180 50	Salaries	1,114 00
Fees received	9 25	Taxes	734 31
Loans repaid	14,965 00	Other expenses	284 32
All other receipts	14,679 85	All other disbursements	15,980 17
		Balance on hand and in bank	2 62
Total receipts	$58,530 19	Total disbursements	$58,530 19

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
126	$126 00	$194 50	$193 50
120	120 00	181 13	181 13
114	114 00	168 33	167 33
108	108 00	156 01	155 01
102	102 00	144 15	142 15
96	96 00	132 78	130 78
90	90 00	121 78	118 78
84	84 00	111 28	108 28
78	78 00	101 14	97 14
72	72 00	91 42	87 42
66	66 00	82 05	77 05
60	60 00	73 05	68 05
54	54 00	64 38	61 40
48	48 00	56 07	53 80
42	42 00	48 04	46 50
36	36 00	40 34	39 35
30	30 00	32 97	32 30
24	24 00	25 86	25 50
18	18 00	19 02	18 85
12	12 00	12 40	12 40
6	6 00	6 10	6 10

No. 75—SAN FRANCISCO.

COMMONWEALTH MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated July 26, 1889.)

JULIAN B. HARRIES, Secretary. LOUIS FISCHBECK, President.

Fiscal year ends August 31, 1899.

No. of series, 15. No. of shares, 353.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$26,763 00	Installment stock—dues	$18,753 00
Arrearages		652 28	Paid-up and prepaid stock	13,100 00
On shares	$436 00		Earnings apportioned	5,811 42
On interest	146 13		Advance payments	5 00
On premiums	70 15		Overdrafts and bills payable	450 00
Cash on hand and in bank		734 28	Reserve and undivided profits	802 92
Real estate owned		10,499 83		
Other assets		272 95		
Total assets		$38,922 34	Total liabilities	$38,922 34

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$688 49	Overdrafts and bills payable	$2,850 00
Installment stock—dues	3,367 00	Loans on mortgages and stock	3,573 00
Paid-up and prepaid stock	200 00	Interest paid	140 10
Interest received	2,497 22	Dues repaid — installment stock	6,611 00
Premiums received	363 45	Profits repaid — installment stock	845 96
Fines received	5 00	Paid-up and prepaid stock and dividends	3,626 53
Fees received	4 00	Salaries	707 50
Loans repaid	10,850 00	Taxes	553 11
Overdrafts and bills payable	1,500 00	Other expenses	500 33
All other receipts	666 65	Balance on hand and in bank	734 28
Total receipts	$20,141 81	Total disbursements	$20,141 81

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	52½	$120 00	$169 52	$156 00
3	46	108 00	145 06	137 16
7	22	96 00	124 26	119 04
11	7	81 00	100 81	97 40
12	16	78 00	96 36	93 21
13	13	72 00	87 47	84 96
14	5	66 00	78 89	76 89
17	6	51 00	58 18	57 50
19	3	42 00	46 58	46 41
20	26	36 00	39 34	39 24
21	5	30 00	32 35	32 25
22	20	18 00	19 02	18 81
23	14	12 00	12 49	12 36
24	30	6 00	6 12	6 09
25	22	3 00	3 04	3 02

No. 76—SAN FRANCISCO.

COSMOS LOAN ASSOCIATION.

(Incorporated April 30, 1890.)

J. S. Hopkins, Secretary. Geo. F. Neal, President.

Fiscal year ends May 17, 1900.

No. of series, 14. No. of shares, 305.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$15,600 00	Installment stock—dues	$21,306 00
Arrearages		266 70	Earnings apportioned	6,298 12
On shares	$100 00		Reserve and undivided profits	4,069 57
On interest	116 70		Other liabilities	30 00
On premiums	50 00			
Cash on hand and in bank		2,115 96		
Real estate owned		13,721 03		
Total assets		$31,703 69	Total liabilities	$31,703 69

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$904 92	Loans on mortgages and stock	$3,100 00
Installment stock—dues	3,660 00	Dues repaid — installment stock	2,725 00
Interest received	1,120 68	Profits repaid — installment stock	355 60
Premiums received	435 80	Salaries	300 00
Fines received	29 32	Taxes	194 57
Fees received	4 50	Other expenses	44 50
Loans repaid	10,650 00	All other disbursements	8,835 19
All other receipts	865 60	Balance on hand and in bank	2,115 96
Total receipts	$17,670 82	Total disbursements	$17,670 82

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	70	$120 00	$163 20	$155 77
2	25	114 00	152 95	144 45
3	19	108 00	143 00	133 76
4	18	102 00	133 20	123 53
5	13	96 00	123 64	112 53
6	5	90 00	114 30	103 42
7	5	84 00	105 17	94 71
11	5	60 00	70 80	63 98
13	50	48 00	54 90	50 22
14	5	42 00	47 29	44 06
16	5	30 00	32 70	30 75
17	20	24 00	25 73	24 40
19	20	12 00	12 43	12 08
20	45	6 00	6 11	6 00

No. 77—SAN FRANCISCO.

ECONOMY BUILDING AND LOAN ASSOCIATION.

(Incorporated December 31, 1889.)

THOMAS W. CHURCH, Secretary. GEORGE A. NEWHALL, President.

Fiscal year ends February 28, 1900.

No. of series, 25. No. of shares, 729.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$48,427 63	Installment stock—dues	$35,691 00
Arrearages		1,260 41	Earnings apportioned	15,222 01
On shares	$540 00		Advance payments	105 96
On interest	720 41		Reserve and undivided profits	1,151 93
Cash on hand and in bank		1,425 61	Unearned premiums	514 50
Real estate owned		2,200 00	Other liabilities	628 25
Total assets		$53,313 65	Total liabilities	$53,313 65

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$241 81	Overdrafts and bills payable	$6,800 00
Installment stock—dues	9,791 00	Loans on mortgages and stock	5,887 63
Interest received	3,921 84	Interest paid	57 38
Premiums received	756 22	Dues repaid — installment stock	15,725 00
Fines received	35 15	Profits repaid — installment stock	5,682 12
Fees received	24 00	Salaries	735 00
Loans repaid	22,160 00	Taxes	591 94
All other receipts	136 73	Other expenses	156 21
		All other disbursements	5 86
		Balance on hand and in bank	1,425 61
Total receipts	$37,066 75	Total disbursements	$37,066 75

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
120	70	$120 00	$195 00	
114	30	114 00	181 72	
102	15	102 00	156 27	
60	15	60 00	78 91	
54	20	54 00	69 35	
48	63	48 00	60 15	Dues and 6%.
42	51	42 00	51 34	
36	17	36 00	42 88	
24	53	24 00	27 10	
18	2	18 00	19 77	
12	30	12 00	12 81	
6	67	6 00	6 22	

No. 78—SAN FRANCISCO.

EINTRACHT SPAR UND BAU VEREIN.

(Incorporated July 12, 1884.)

HENRY GILLE, Secretary. F. HUFSCHMIDT, President.

Fiscal year ends June 30, 1899.

No. of series, 10. No. of shares, 1,590.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$66,225 00	Installment stock—dues	$69,960 00
Arrearages		13,375 60	Earnings apportioned	10,495 57
On shares	$8,023 00		Advance payments	370 25
On interest	5,352 60		Reserve and undivided profits	3,143 98
Cash on hand and in bank		4,062 40	Other liabilities	393 20
Real estate owned		600 00		
Other assets		100 00		
Total assets		$84,363 00	Total liabilities	$84,363 00

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,205 54	Overdrafts and bills payable	$1,400 00
Installment stock—dues	19,938 00	Loans on mortgages and stock	12,375 00
Interest received	4,793 95	Interest paid	5 85
Fines received	244 92	Dues repaid — installment stock	29,772 00
Fees received	23 80	Profits repaid — installment stock	5,687 49
Loans repaid	27,425 00	Salaries	480 00
Overdrafts and bills payable	1,400 00	Taxes	1,219 34
All other receipts	112 47	Other expenses	141 60
		Balance on hand and in bank	4,062 40
Total receipts	$55,143 68	Total disbursements	$55,143 68

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
10	193	$72 00	$86 96	$81 97
11	397	60 00	70 42	65 25
12	193	48 00	54 70	50 23
13	107	42 00	47 14	43 28
14	201	36 00	39 79	36 94
15	240	30 00	32 65	30 44
16	94	24 00	25 71	24 28
17	33	18 00	18 98	18 00
18	68	12 00	12 44	12 00
19	64	6 00	6 12	6 00

No. 79—SAN FRANCISCO.

EL DORADO LOAN ASSOCIATION.

(Incorporated March 14, 1890.)

E. GUNZBURGER, Secretary. GEO. W. DIXON, President.

Fiscal year ends March 14, 1900.

No. of series, 7. No. of shares, 678.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$38,250 00	Installment stock—dues	$69,264 00
Arrearages		21,112 00	Advance payments	45 00
On shares	$17,522 00		Reserve and undivided profits	16,506 12
On interest	3,431 50			
On premiums	158 50			
Cash on hand and in bank		349 54		
Real estate owned		25,055 83		
Other assets		1,047 75		
Total assets		$85,815 12	Total liabilities	$85,815 12

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$81 82	Loans on mortgages and stock	$200 00
Installment stock—dues	4,015 00	Interest paid	1 40
Interest received	2,053 00	Dues repaid — installment stock	6,990 00
Premiums received	190 75	Salaries	720 00
Fees received	2 50	Taxes	649 30
Loans repaid	2,200 00	Other expenses	249 75
All other receipts	1,518 30	All other disbursements	901 38
		Balance on hand and in bank	349 54
Total receipts	$10,061 37	Total disbursements	$10,061 37

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	280	$120 00	$120 00	$120 00
2	70	108 00	108 00	108 00
3	96	96 00	96 00	96 00
4	214	84 00	84 00	84 00
5	5	72 00	72 00	72 00
7	10	48 00	48 00	48 00
8	3	24 00	24 00	24 00

No. 80—SAN FRANCISCO.

EMPIRE BUILDING AND LOAN ASSOCIATION.

(Incorporated August 24, 1889.)

WILLIAM E. LUTZ, Secretary. MARION LEVENTRITT, President.

Fiscal year ends August 31, 1899.

No. of series, 10. No. of shares, 1,128.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$123,125 00	Installment stock—dues	$92,124 00
Arrearages		1,883 67	Earnings apportioned	33,150 58
On shares	$970 00		Advance payments	30 00
On interest	891 17		Reserve and undivided profits	6,000 00
On premiums	22 50			
Cash on hand and in bank		1,946 87		
Real estate owned		4,349 04		
Total assets		$131,304 58	Total liabilities	$131,304 58

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,313 04	Loans on mortgages and stock	$2,660 00
Installment stock—dues	13,483 00	Interest paid	126 52
Interest received	8,176 58	Dues repaid — installment stock	17,666 00
Premiums received	119 50	Profits repaid — installment stock	5,923 47
Fines received	81 52	Salaries	1,382 50
Fees received	11 30	Taxes	1,356 10
Loans repaid	6,100 00	Other expenses	230 20
All other receipts	38 15	All other disbursements	31 43
		Balance on hand and in bank	1,946 87
Total receipts	$31,323 09	Total disbursements	$31,323 09

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	372	$120 00	$172 66	
2	93	108 00	150 69	
3	78	96 00	129 77	
4	60	84 00	109 89	
5	163	72 00	91 06	Dues and 6 %
6	97	60 00	73 28	
7	89	48 00	56 52	
8	18	36 00	40 83	
9	45	24 00	26 17	
10	113	12 00	12 56	

No. 81—SAN FRANCISCO.

EUREKA LOAN ASSOCIATION.

(Incorporated May 16, 1889.)

D. Hirschfeld, Secretary. Wm. Nicol, President.

Fiscal year ends May 31, 1899.

No. of series, 8. No. of shares, 440.

Financial Statement.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$28,760 00	Installment stock—dues	$31,608 00
Arrearages	618 00	Earnings apportioned	6,920 99
On shares $618 00		Reserve and undivided profits	5,001 65
Cash on hand and in bank	2,306 71	Unearned premiums	1,687 55
Real estate owned	17,371 03	Other liabilities	3,882 95
Other assets	45 40		
Total assets	$49,101 14	Total liabilities	$49,101 14

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$9,638 87	Loans on mortgages and stock	$860 00
Installment stock—dues	5,883 00	Interest paid	23 83
Interest received	2,553 25	Dues repaid — installment stock	27,594 00
Premiums received	836 05	Profits repaid — installment stock	681 30
Loans repaid	13,810 00	Salaries	720 00
All other receipts	1,034 40	Taxes	642 68
		Other expenses	382 65
		All other disbursements	544 40
		Balance on hand and in bank	2,306 71
Total receipts	$33,755 57	Total disbursements	$33,755 57

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	82	$120 00	$157 31	$138 65
3	59	96 00	119 93	108 00
4	19	84 00	102 34	93 00
5	29	72 00	85 50	78 75
6	118	60 00	69 40	64 70
7	80	48 00	54 04	51 02
8	19	36 00	39 42	37 70
9	34	24 00	25 54	24 80

No. 82—SAN FRANCISCO.

EUREKA BUILDING AND LOAN ASSOCIATION.

(Incorporated November 3, 1890.)

SOL. J. LEVY, Secretary. A. ANDREWS, President.

Fiscal year ends October 31, 1899.

No. of series, 16. No. of shares, 809.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$51,525 00	Installment stock—dues	$45,558 00
Arrearages		841 80	Earnings apportioned	15,529 20
On shares	$482 00		Advance payments	5 00
On interest	251 85		Reserve and undivided profits	346 50
On premiums	107 95			
Cash on hand and in bank		6,002 60		
Real estate owned		3,069 30		
Total assets		$61,438 70	Total liabilities	$61,438 70

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,526 57	Loans on mortgages and stock	$3,500 00
Installment stock—dues	10,224 00	Interest paid	4 17
Interest received	3,693 59	Dues repaid — installment stock	10,607 00
Premiums received	1,517 93	Profits repaid — installment stock	3,368 40
Fees received	5 85	Salaries	840 00
Loans repaid	7,100 00	Taxes	695 79
All other receipts	10 20	Other expenses	40 88
		All other disbursements	19 30
		Balance on hand and in bank	6,002 60
Total receipts	$25,078 14	Total disbursements	$25,078 14

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	30	$108 00	$163 50	$157 95
2	150	103 00	153 89	146 25
3	15	93 00	134 59	120 00
4	55	84 00	116 24	101 73
5	41	78 00	104 85	92 75
6	20	72 00	93 57	83 85
7	37	66 00	83 57	74 75
9	27	54 00	65 15	58 45
10	30	48 00	56 42	51 35
11	42	42 00	48 26	44 50
12	62	36 00	40 39	37 75
13	115½	30 00	32 93	31 15
14	97½	24 00	25 81	24 70
15	28½	18 00	19 02	18 40
16	35	12 00	12 45	12 18
17	23½	6 00	6 12	6 04

No. 83—SAN FRANCISCO.

EXCELSIOR LOAN ASSOCIATION.

(Incorporated January 9, 1889.)

N. SCHLESINGER, Secretary. CHARLES HARRIS, President.

Fiscal year ends December 31, 1899.

No. of series, 10. No. of shares, 1,289.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$104,600 00	Installment stock—dues	$131,172 00
Arrearages		9,709 92	Earnings apportioned	39,310 45
On shares	$4,638 00		Overdrafts and bills payable	9,021 02
On interest	5,071 92		Reserve and undivided profits	29,951 15
Real estate owned		95,144 70		
Total assets		$209,454 62	Total liabilities	$209,454 62

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$25,567 00	Overdrafts and bills payable	$14,339 75
Interest received	15,296 71	Loans on mortgages and stock	3,400 00
Fees received	6 20	Interest paid	937 22
Loans repaid	95,500 00	Dues repaid — installment stock	72,292 00
Overdrafts and bills payable	9,021 02	Profits repaid — installment stock	17,931 04
All other receipts	2,352 71	Salaries	1,827 50
		Taxes	1,712 72
		Other expenses	123 21
		All other disbursements	35,180 20
Total receipts	$147,743 64	Total disbursements	$147,743 64

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	670	$132 00	$176 71	$172 24
2	112	120 00	156 98	141 58
4	63	96 00	119 71	115 60
5	59	84 00	102 18	94 80
6	75	72 00	85 38	78 69
7	100	60 00	69 32	63 73
8	93	48 00	53 99	49 80
9	10	36 00	39 39	36 77
10	65	24 00	25 33	24 16
11	42	12 00	12 40	12 00

No. 84—SAN FRANCISCO.

FAIRMOUNT LOAN ASSOCIATION.

(Incorporated March 2, 1891.)

T. F. CREIGHTON, Secretary. JOHN H. GRADY, President.

Fiscal year ends April 30, 1900.

No. of series, 18. No. of shares, 1,223⅝.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$71,875 00	Installment stock—dues	$51,829 12
Arrearages		4,294 25	Earnings apportioned	16,476 01
On shares	$1,663 75		Advance payments	47 95
On interest	1,738 00		Overdrafts and bills payable	10,567 08
On premiums	892 50		Reserve and undivided profits	1,558 79
Real estate owned		4,590 73	Unearned premiums	315 00
Other assets		157 17	Other liabilities	123 20
Total assets		$80,917 15	Total liabilities	$80,917 15

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$15,286 74	Overdrafts and bills payable	$846 92
Interest received	4,626 30	Loans on mortgages and stock	13,926 80
Premiums received	2,712 86	Interest paid	31 53
Fines received	143 85	Dues repaid — installment stock	21,648 25
Fees received	36 00	Profits repaid — installment stock	7,254 00
Loans repaid	13,575 00	Salaries	1,242 00
Overdrafts and bills payable	10,567 08	Taxes	599 23
All other receipts	1,796 32	Other expenses	231 41
		All other disbursements	2,964 01
Total receipts	$48,744 15	Total disbursements	$48,744 15

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
108	$108 00	$163 40	$156 60
95	95 00	137 86	132 61
83	83 00	115 72	111 70
71	71 00	94 94	89 90
59	59 00	75 53	70 60
47	47 00	57 49	53 44
35	35 00	40 81	38 07
23	23 00	25 51	24 32
11	11 00	11 57	11 30

No. 85—SAN FRANCISCO.

FIDELITY BUILDING AND LOAN ASSOCIATION.

(Incorporated March 19, 1887.)

WM. E. LUTZ, Secretary. SAMUEL J. HENDY, President.

Fiscal year ends March 31, 1900.

No. of series, 15. No. of shares, 1,591.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$134,265 00	Installment stock—dues	$93,408 00
Arrearages		3,529 53	Earnings apportioned	30,212 75
On shares	$2,011 00		Advance payments	151 10
On interest	1,250 28		Overdrafts and bills payable	18,739 35
On premiums	268 25		Reserve and undivided profits	10,000 00
Cash on hand and in bank		42 45	Unearned premiums	2,940 48
Real estate owned		23,695 93	Other liabilities	6,212 78
Other assets		131 55		
Total assets		$161,664 46	Total liabilities	$161,664 46

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$19,045 00	Overdrafts and bills payable	$4,142 27
Interest received	8,816 73	Loans on mortgages and stock	18,735 00
Premiums received	1,254 55	Interest paid	1,340 16
Fines received	151 90	Dues repaid—installment stock	41,201 00
Fees received	23 80	Profits repaid—installment stock	16,922 81
Loans repaid	53,131 00	Salaries	2,217 50
Overdrafts and bills payable	4,739 35	Taxes	1,164 62
All other receipts	873 50	Other expenses	232 91
		All other disbursements	2,037 11
		Balance on hand and in bank	42 45
Total receipts	$88,035 83	Total disbursements	$88,035 83

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
3	135	$132 00	$195 65	Dues and 50% to 90% of profits.
4	80	120 00	172 64	
5	151	108 00	150 68	
6	116	96 00	129 76	
7	88	84 00	109 88	
8	56	72 00	91 05	
9	52	60 00	73 27	
10	83	48 00	56 52	
11	45	42 00	48 54	
12	163	36 00	40 82	
13	40	30 00	33 37	
14	310	24 00	26 17	
15	34	18 00	19 24	
16	168	12 00	12 56	
17	65	6 00	6 15	

No. 86—SAN FRANCISCO.

FRANKLIN SAVINGS AND BUILDING ASSOCIATION.

(Incorporated November 18, 1875.)

WILLIAM HATJE, Secretary. F. LUDEMANN, President.

Fiscal year ends November 30, 1899.

No. of series, 2. No. of shares, 1,502.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$159,400 00	Installment stock—dues	$143,436 00
Arrearages	2,028 00	Earnings apportioned	23,355 90
On shares $1,720 00		Reserve and undivided profits	310 10
On interest 276 00			
On fines, etc. 32 00			
Cash on hand and in bank	5,318 00		
Other assets	356 00		
Total assets	$167,102 00	Total liabilities	$167,102 00

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$5,234 55	Loans on mortgages and stock	$43,800 00
Installment stock—dues	37,092 00	Dues repaid — installment stock	3,240 00
Interest received	10,662 00	Profits repaid — installment stock	190 00
Premiums received	30 00	Salaries	480 00
Fines received	28 20	Taxes	1,039 75
Fees received	7 00	Other expenses	139 00
Loans repaid	1,200 00	All other disbursements	47 00
		Balance on hand and in bank	5,318 00
Total receipts	$54,253 75	Total disbursements	$54,253 75

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
5	906	880	$122 00	$144 83	$137 00
6	604	622	58 00	63 25	60 00

No. 87—SAN FRANCISCO.

GERMANIA BUILDING AND LOAN ASSOCIATION.

(Incorporated June 6, 1889.)

RUDOLPH MOHR, Secretary. H. PLAGEMAN, Vice-President.

Fiscal year ends July 7, 1899.

No. of series, 8. No. of shares, 3,784.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$522,650 00	Installment stock—dues	$394,296 00
Arrearages	5,768 79	Earnings apportioned	230,451 00
On shares $2,173 00		Advance payments	2,344 40
On interest 2,085 00		Reserve and undivided profits	34 73
On premiums 1,058 18		Other liabilities	2,798 45
On fines, etc. 452 61			
Cash on hand and in bank	6,199 91		
Real estate owned	81,000 00		
Other assets	14,305 88		
Total assets	$629,924 58	Total liabilities	$629,924 58

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$16,532 61	Loans on mortgages and stock	$127,183 73
Installment stock—dues	46,502 00	Interest paid	293 77
Interest received	27,923 40	Dues repaid — installment stock	38,852 00
Premiums received	10,627 94	Profits repaid — installment stock	18,558 58
Fines received	175 69	Salaries	1,800 00
Fees received	25 55	Taxes	3,445 82
Loans repaid	98,400 00	Other expenses	462 14
All other receipts	4,813 93	All other disbursements	8,205 17
		Balance on hand and in bank	6,199 91
Total receipts	$205,001 12	Total disbursements	$205,001 12

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	3,002	$120 00	$194 25	$175 68
2	143	84 00	112 30	102 39
3	76	72 00	91 16	83 49
4	99	60 00	72 16	66 68
5	44	48 00	55 01	51 50
6	103	36 00	39 46	37 73
7	84	24 00	25 32	24 66
8	233	12 00	12 30	12 15

No. 88—SAN FRANCISCO.

GOLDEN GATE MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated August 31, 1892.)

J. M. Ellis, Secretary. George F. Neal, President.

Fiscal year ends August 31, 1899.

No. of series, 6. No. of shares, 530.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$21,900 00	Installment stock—dues	$36,735 00
Arrearages		783 10	Reserve and undivided profits	5,126 89
On shares	$470 00		Other liabilities	40 00
On interest	289 35			
On premiums	23 75			
Cash on hand and in bank		3,392 77		
Real estate owned		5,750 00		
Other assets		10,076 02		
Total assets		$41,901 89	Total liabilities	$41,901 89

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$5,993 00	Overdrafts and bills payable	$5,917 78
Interest received	1,552 25	Interest paid	138 28
Premiums received	124 75	Dues repaid — installment stock	10,763 00
Loans repaid	9,200 00	Salaries	600 00
All other receipts	7,573 03	Taxes	448 06
		Other expenses	33 20
		All other disbursements	3,149 94
		Balance on hand and in bank	3,392 77
Total receipts	$24,443 03	Total disbursements	$24,443 03

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	322½	$84 00	$84 00	$84 00
2	22½	78 00	78 00	78 00
3	25	66 00	66 00	66 00
4	75	60 00	60 00	60 00
5	20	48 00	48 00	48 00
7	65	12 00	12 00	12 00

No. 89—SAN FRANCISCO.

GOLDEN RULE MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated May 17, 1892.)

JOHN BRUCKMAN, Secretary. PAUL M. NIPPERT, President.

Fiscal year ends May 31, 1900.

No. of series, 14. No. of shares, 766.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$58,400 00	Installment stock—dues	$45,360 00
Arrearages		525 30	Earnings apportioned	9,493 90
On shares	$179 00		Overdrafts and bills payable	3,500 00
On interest	208 95		Reserve and undivided profits	4,084 15
On premiums	89 50			
On fines, etc.	47 85			
Cash on hand and in bank		254 85		
Real estate owned		3,257 90		
Total assets		$62,438 05	Total liabilities	$62,438 05

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$129 34	Overdrafts and bills payable	$18,000 00
Installment stock—dues	10,035 00	Loans on mortgages and stock	7,700 00
Interest received	3,992 00	Interest paid	579 58
Premiums received	1,533 20	Dues repaid — installment stock	18,373 00
Fines received	58 50	Profits repaid — installment stock	3,569 97
Fees received	17 50	Salaries	1,102 50
Loans repaid	8,930 00	Taxes	714 84
Overdrafts and bills payable	17,000 00	Other expenses	69 08
All other receipts	8,877 13	All other disbursements	208 85
		Balance on hand and in bank	254 85
Total receipts	$50,572 67	Total disbursements	$50,572 67

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	195	$96 00	$121 05	$119 05
2	54	90 00	112 01	110 25
3	11	84 00	103 18	101 65
4	75	78 00	94 53	93 20
5	45	72 00	86 09	84 95
7	5	60 00	69 78	69 00
8	84	54 00	61 92	60 05
9	64	48 00	54 26	52 80
11	10	36 00	39 52	38 70
12	28	30 00	32 44	31 50
13	30	24 00	25 56	24 95
14	25	18 00	18 86	18 55
15	108	12 00	12 39	12 18
16	32	6 00	6 09	6 00

No. 90—SAN FRANCISCO.

GOLDEN WEST BUILDING AND LOAN ASSOCIATION.

(Incorporated May, 1890.)

SOL. J. LEVY, Secretary. G. BREMER, President.

Fiscal year ends June 30, 1899.

No. of series, 17. No. of shares, 538½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$40,700 00	Installment stock—dues	$39,306 00
Arrearages		184 75	Earnings apportioned	7,289 04
On shares	$71 00		Reserve and undivided profits	7,408 07
On interest	82 75		Unearned premiums	1,210 00
On premiums	31 00			
Cash on hand and in bank		2,314 94		
Real estate owned		11,935 17		
Other assets		78 25		
Total assets		$55,213 11	Total liabilities	$55,213 11

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$11,114 97	Dues repaid — installment stock	$22,085 00
Installment stock—dues	7,112 00	Profits repaid — installment stock	3,836 65
Interest received	2,865 75	Salaries	895 00
Premiums received	741 00	Taxes	521 57
Fees received	4 50	Other expenses	163 88
Loans repaid	8,000 00	All other disbursements	271 57
All other receipts	250 40	Balance on hand and in bank	2,314 94
Total receipts	$30,088 62	Total disbursements	$30,088 62

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
108	$108 00	$137 72	$132 50
96	96 00	115 98	108 98
87	87 00	101 47	95 60
78	78 00	88 54	83 79
72	72 00	80 37	76 60
60	60 00	65 26	62 89
48	48 00	51 32	49 66
36	36 00	37 92	36 96
18	18 00	18 59	18 27
12	12 00	12 24	12 12

No. 91—SAN FRANCISCO.

GLOBE MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated March 30, 1890.)

FRED H. CLARK, Secretary. FRANK OTIS, President.

Fiscal year ends March 31, 1900.

No. of series, 6. No. of shares, 2,961.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$42,700 00	Installment stock—dues	$27,124 50
Arrearages	85 00	Earnings apportioned	1,619 23
On shares $85 00		Advance payments	2,357 50
Cash on hand and in bank	1,315 25	Overdrafts and bills payable	10,986 35
Other assets	142 00	Reserve and undivided profits	114 66
		Other liabilities	2,040 01
Total assets	$44,242 25	Total liabilities	$44,242 25

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$26 85	Overdrafts and bills payable	$11,129 35
Installment stock—dues	17,491 50	Loans on mortgages and stock	30,510 50
Interest received	2,833 75	Interest paid	713 01
Fees received	60 00	Dues repaid — installment stock	7 50
Loans repaid	1,725 00	Salaries	210 00
Overdrafts and bills payable	22,115 70	Taxes	175 84
All other receipts	950 00	Other expenses	167 85
		All other disbursements	973 50
		Balance on hand and in bank	1,315 25
Total receipts	$45,202 80	Total disbursements	$45,202 80

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	1,755	$12 00	$12 80	$12 60
2	225	9 00	9 45	9 39
3	290	6 00	6 21	6 16
4	350	4 50	4 62	4 58
5	142	3 00	3 05	3 03
6	199	1 50	1 52	1 50

No. 92—SAN FRANCISCO.

GRANITE MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated August 22, 1893.)

M. L. CULVER, Secretary. M. C. NUNAN, President.

Fiscal year ends August 31, 1899.

No. of series, 12. No. of shares, 687.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$40,590 00	Installment stock—dues	$29,208 00
Arrearages		1,718 70	Earnings apportioned	5,725 32
On shares	$207 00		Overdrafts and bills payable	13,897 16
On interest	667 70		Reserve and undivided profits	7 91
On premiums	344 00		Other liabilities	215 90
Real estate owned		6,326 37		
Other assets		419 22		
Total assets		$49,054 29	Total liabilities	$49,054 29

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$8,825 00	Overdrafts and bills payable	$19,085 83
Interest received	3,132 10	Loans on mortgages and stock	5,490 00
Premiums received	1,525 00	Interest paid	1,464 47
Fines received	11 95	Dues repaid — installment stock	6,649 00
Fees received	15 70	Profits repaid — installment stock	683 74
Loans repaid	8,125 00	Salaries	1,368 00
Overdrafts and bills payable	13,897 16	Taxes	580 49
All other receipts	550 10	Other expenses	278 18
		All other disbursements	482 30
Total receipts	$36,082 01	Total disbursements	$36,082 01

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
72	$72 00	$90 35	$84 96
60	60 00	72 78	69 00
48	48 00	56 21	53 76
36	36 00	40 65	39 24
24	24 00	26 09	25 44
12	12 00	12 54	12 36
6	6 00	6 14	6 09

No. 93—SAN FRANCISCO.

GUARDIAN LOAN ASSOCIATION.

(Incorporated April, 1890.)

SOL. J. LEVY, Secretary. A. J. BARNETT, President.

Fiscal year ends April 30, 1900.

No. of series, 5. No. of shares, 230.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$27,000 00	Installment stock—dues	$23,646 00
Arrearages		975 25	Earnings apportioned	8,546 85
On shares	$499 00		Reserve and undivided profits	3,755 86
On interest	453 75		Unearned premiums	1,600 00
On premiums	22 50		Other liabilities	61 35
Cash on hand and in bank		1,115 25		
Real estate owned		4,029 42		
Other assets		4,490 14		
Total assets		$37,610 06	Total liabilities	$37,610 06

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,449 29	Dues repaid — installment stock	$11,281 00
Installment stock—dues	3,641 00	Profits repaid — installment stock	2,326 20
Interest received	2,240 77	Salaries	480 00
Premiums received	201 25	Taxes	377 33
Fines received	14 00	Other expenses	20 25
Fees received	1 50	All other disbursements	201 98
Loans repaid	6,300 00	Balance on hand and in bank	1,115 25
All other receipts	954 20		
Total receipts	$15,802 01	Total disbursements	$15,802 01

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	211	136	$120 00	$169 62	$164 65
3	31	12	96 00	125 05	122 14
4	45	45	84 00	105 32	101 05
5	14½	14½	72 00	88 14	84 91
6	32½	22½	60 00	71 40	69 12

No. 94—SAN FRANCISCO.

HOME INVESTMENT ASSOCIATION.

(Incorporated March 22, 1890.)

JOHN KENNY, Secretary. J. F. SULLIVAN, President.

Fiscal year ends March 31, 1900.

No. of series, 11. No. of shares, 790½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$83,415 25	Installment stock—dues	$73,740 00
Arrearages		15,434 90	Earnings apportioned	36,381 10
On shares	$6,297 50		Advance payments	10 00
On interest	8,121 25		Reserve and undivided profits	1,212 99
On premiums	1,016 15			
Cash on hand and in bank		767 29		
Real estate owned		11,372 45		
Other assets		354 20		
Total assets		$111,344 09	Total liabilities	$111,344 09

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,824 11	Loans on mortgages and stock	$7,850 00
Installment stock—dues	8,415 90	Interest paid	77 46
Interest received	3,175 47	Dues repaid — installment stock	8,403 00
Premiums received	995 95	Profits repaid — installment stock	2,412 15
Fines received	174 84	Salaries	960 00
Loans repaid	8,254 55	Taxes	921 90
All other receipts	450 00	Other expenses	423 12
		All other disbursements	1,475 90
		Balance on hand and in bank	767 29
Total receipts	$23,290 82	Total disbursements	$23,290 82

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	412½	$112 00	$185 78	$157 51
2	73	114 00	174 06	140 72
3	45	108 00	161 08	131 16
5	5	96 00	136 14	112 72
6	10	84 00	113 67	103 17
7	35½	72 00	92 78	85 88
8	51	60 00	74 00	69 59
9	40	48 00	56 72	54 10
10	15	36 00	40 78	39 41
11	35	24 00	26 04	25 50
12	68½	12 00	12 48	12 39

No. 95—SAN FRANCISCO.

HOME MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated December 2, 1885.)

CHARLES K. CLARK, Secretary. GEORGE MEARNS, President.

Fiscal year ends December 31, 1899.

No. of series, 32. No. of shares, 2,327.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$127,795 00	Installment stock—dues	$110,174 00
Arrearages		2,367 75	Earnings apportioned	35,314 71
On shares	$929 00		Advance payments	393 40
On interest	992 65		Overdrafts and bills payable	796 97
On premiums	201 10		Reserve and undivided profits	2,063 04
On fines, etc.	245 00		Other liabilities	1,265 22
Real estate owned		19,679 84		
Other assets		164 75		
Total assets		$150,007 34	Total liabilities	$150,007 34

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$29,590 40	Overdrafts and bills payable	$1,369 29
Interest received	13,937 70	Loans on mortgages and stock	62,905 00
Premiums received	920 40	Interest paid	403 39
Fines received	234 80	Dues repaid — installment stock	34,338 00
Fees received	14 10	Profits repaid — installment stock	12,368 46
Loans repaid	67,695 00	Salaries	900 00
Overdrafts and bills payable	796 97	Taxes	834 18
All other receipts	6,927 75	Other expenses	880 95
		All other disbursements	6,117 85
Total receipts	$120,117 12	Total disbursements	$120,117 12

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
126	$126 00	$200 00	$200 00
120	120 00	192 45	191 45
114	114 00	178 20	177 20
108	108 00	164 75	163 75
102	102 00	151 78	149 78
96	96 00	139 38	137 38
90	90 00	127 50	124 50
84	84 00	116 14	113 14
78	78 00	105 26	101 26
72	72 00	94 86	90 86
66	66 00	84 90	79 90
60	60 00	75 38	70 38
54	54 00	66 26	61 40
48	48 00	57 54	53 80
42	42 00	49 19	46 50
36	36 00	41 21	39 35
30	30 00	33 56	32 30
24	24 00	26 25	25 50
18	18 00	19 24	18 85
12	12 00	12 55	12 40
6	6 00	6 10	6 10

No. 96—SAN FRANCISCO.

HOUSEHOLDERS BUILDING AND LOAN ASSOCIATION.

(Incorporated October 5, 1889.)

THOMAS W. CHURCH, Secretary. ROBERT HUSBAND, President.

Fiscal year ends October 31, 1899.

No. of series, 24. No. of shares, 434.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$33,515 00	Installment stock—dues	$29,526 00
Arrearages		620 20	Earnings apportioned	12,795 65
On shares	$263 00		Advance payments	43 34
On interest	282 00		Reserve and undivided profits	1,273 52
On premiums	75 20		Unearned premiums	403 87
Cash on hand and in bank		889 44	Other liabilities	215 00
Real estate owned		9,202 74		
Other assets		30 00		
Total assets		$44,257 38	Total liabilities	$44,257 38

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$5,942 00	Overdrafts and bills payable	$3,254 77
Interest received	2,884 71	Loans on mortgages and stock	1,140 00
Premiums received	652 92	Interest paid	132 76
Fines received	64 09	Dues repaid — installment stock	5,572 00
Fees received	7 60	Profits repaid — installment stock	1,968 67
Loans repaid	5,600 00	Salaries	530 00
Overdrafts and bills payable	500 00	Taxes	528 83
All other receipts	810 49	Other expenses	122 78
		All other disbursements	2,322 56
		Balance on hand and in bank	889 44
Total receipts	$16,461 81	Total disbursements	$16,461 81

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
120	$120 00	$183 35	Dues and 6% interest.
108	108 00	159 36	
84	84 00	115 15	
66	66 00	85 29	
45	45 00	54 03	
36	36 00	41 80	
24	24 00	26 61	
12	12 00	12 68	
6	6 00	6 18	

No. 97—SAN FRANCISCO.

HUMBOLDT BUILDING AND LOAN ASSOCIATION.

(Incorporated September, 1890.)

RUDOLPH MOHR, Secretary. HERMANN JOOST, President.

Fiscal year ends October 9, 1899.

No. of series, 8. No. of shares, 2,468.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$222,350 00	Installment stock—dues	$184,788 00
Arrearages		2,461 05	Earnings apportioned	81,416 47
On shares	$834 00		Advance payments	737 70
On interest	834 00		Reserve and undivided profits	224 43
On premiums	500 40		Other liabilities	5,463 70
On fines, etc.	292 65			
Cash on hand and in bank		31,986 28		
Real estate owned		10,684 41		
Other assets		5,148 56		
Total assets		$272,630 30	Total liabilities	$272,630 30

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$45,108 48	Loans on mortgages and stock	$63,280 17
Installment stock—dues	31,959 00	Dues repaid — installment stock	19,195 00
Interest received	13,546 45	Profits repaid — installment stock	5,544 72
Premiums received	5,865 41	Salaries	1,200 00
Fines received	273 42	Taxes	1,814 46
Fees received	26 90	Other expenses	282 85
Loans repaid	32,900 00	All other disbursements	7,421 19
All other receipts	1,045 01	Balance on hand and in bank	31,986 28
Total receipts	$130,724 67	Total disbursements	$130,724 67

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	1,193	$108 00	$165 41	$151 05
2	302	84 00	113 26	103 01
3	20	72 00	91 89	83 93
4	45	60 00	72 88	67 08
5	284	48 00	55 64	51 82
6	73	36 00	40 03	38 01
7	297	24 00	25 79	24 89
8	254	12 00	12 46	12 23

No. 98—SAN FRANCISCO.

INTER NOS BUILDING AND LOAN ASSOCIATION.

(Incorporated May 22, 1889.)

M. L. CULVER, Secretary. M. C. NUNAN, President.

Fiscal year ends May 31, 1900.

No. of series, 21. No. of shares, 1,762.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$135,800 00	Installment stock—dues	$87,170 00
Arrearages		9,597 35	Earnings apportioned	29,889 80
On shares	$3,398 00		Overdrafts and bills payable	28,807 56
On interest	4,057 65		Reserve and undivided profits	2,552 86
On premiums	2,141 70		Unearned premiums	864 22
Real estate owned		15,934 37	Other liabilities	14,543 02
Other assets		2,495 74		
Total assets		$163,827 46	Total liabilities	$163,827 46

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$21,748 00	Overdrafts and bills payable	$16,074 04
Interest received	9,311 70	Loans on mortgages and stock	9,572 00
Premiums received	3,952 30	Interest paid	2,264 43
Fines received	53 20	Dues repaid — installment stock	44,200 00
Fees received	36 00	Profits repaid — installment stock	23,928 37
Loans repaid	36,000 00	Salaries	1,872 00
Overdrafts and bills payable	28,807 56	Taxes	1,964 83
All other receipts	15,436 75	Other expenses	970 08
		All other disbursements	14,499 76
Total receipts	$115,345 51	Total disbursements	$115,345 51

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
125	$125 00	$196 00	$196 00
120	120 00	184 02	184 02
108	108 00	159 75	142 16
96	96 00	136 85	119 04
84	84 00	115 23	101 64
72	72 00	94 99	84 96
60	60 00	76 01	69 00
48	48 00	58 28	53 76
36	36 00	41 82	39 24
24	24 00	26 62	25 41
12	12 00	12 68	12 36
6	6 00	6 18	6 09

No. 99—SAN FRANCISCO.

ITALIAN-SWISS MUTUAL LOAN ASSOCIATION.

(Incorporated April 1, 1887.)

A. SBARBORO, Secretary. P. BARBIERI, President.

Fiscal year ends March 31, 1900.

No. of series, 13. No. of shares, 2,014½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$160,150 00	Installment stock—dues	$151,501 00
Arrearages		2,002 15	Earnings apportioned	38,431 78
On shares	$1,143 50		Advance payments	116 00
On interest	696 00		Reserve and undivided profits	5,260 52
On premiums	75 00		Other liabilities	1,520 00
On fines, etc.	87 65			
Cash on hand and in bank		13,323 41		
Real estate owned		21,039 89		
Other assets		313 85		
Total assets		$196,829 30	Total liabilities	$196,829 30

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$6,118 78	Loans on mortgages and stock	$3,050 00
Installment stock—dues	26,216 50	Interest paid	424 63
Interest received	10,596 17	Dues repaid — installment stock	58,298 50
Premiums received	816 05	Profits repaid — installment stock	18,089 44
Fines received	346 55	Salaries	2,400 00
Fees received	14 45	Taxes	2,551 23
Loans repaid	51,250 00	Other expenses	474 10
All other receipts	7,604 95	All other disbursements	4,352 14
		Balance on hand and in bank	13,323 41
Total receipts	$102,963 45	Total disbursements	$102,963 45

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	7½	$132 00	$200 00	$200 00
2	35	137 00	200 00	200 00
3	148½	132 00	186 57	172 92
4	143	120 00	163 04	152 28
5	292½	108 00	141 21	132 90
6	126½	96 00	120 98	114 73
7	229	84 00	100 22	96 16
8	91	72 00	83 21	78 72
9	277½	60 00	67 25	64 35
10	271½	48 00	52 60	50 30
11	127½	36 00	38 61	37 30
12	165	24 00	25 30	24 65
13	100	12 00	12 42	12 21

No. 100—SAN FRANCISCO.

MECHANICS BUILDING AND LOAN ASSOCIATION.

(Incorporated January 6, 1891.)

WILLIAM E. LUTZ, Secretary. FREDERICK FILLMORE, President.

Fiscal year ends December 31, 1899.

No. of series, 13. No. of shares, 1,037.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$75,000 00	Installment stock—dues	$66,852 00
Arrearages		1,253 85	Earnings apportioned	17,191 07
On shares	$684 00		Advance payments	30 00
On interest	467 85		Reserve and undivided profits	1,200 00
On premiums	102 00		Other liabilities	338 57
Cash on hand and in bank		618 69		
Real estate owned		8,685 31		
Other assets		53 79		
Total assets		$85,611 64	Total liabilities	$85,611 64

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,384 63	Loans on mortgages and stock	$14,400 00
Installment stock—dues	12,844 00	Interest paid	3 29
Interest received	5,029 89	Dues repaid — installment stock	10,198 00
Premiums received	403 00	Profits repaid — installment stock	2,079 52
Fines received	1 00	Salaries	900 00
Fees received	19 70	Taxes	696 97
Loans repaid	6,940 00	Other expenses	64 21
All other receipts	464 50	All other disbursements	126 04
		Balance on hand and in bank	618 69
Total receipts	$29,086 72	Total disbursements	$29,086 72

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	132	$108 00	$143 86	
2	235	96 00	124 37	
3	95	84 00	105 75	
4	155	72 00	88 01	
5	37	60 00	71 15	
6	54	48 00	55 16	Dues and 6%
7	39	42 00	47 50	
8	24	36 00	40 06	
9	12	30 00	32 83	
10	25	24 00	25 82	
11	39	18 00	19 04	
12	164	12 00	12 47	
13	28	6 00	6 13	

No. 101—SAN FRANCISCO.

MERCHANTS LOAN ASSOCIATION.

(Incorporated June 21, 1889.)

J. B. Brooks, Secretary. P. N. Aronson, President.

Fiscal year ends June 30, 1899.

No. of series, 5. No. of shares, 504½.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$48,460 23	Installment stock—dues	$58,128 00
Arrearages		305 60	Earnings apportioned	12,038 50
On shares	$114 00		Reserve and undivided profits	13,490 96
On interest	100 60		Unearned premiums	1,137 96
On rents	91 00		Other liabilities	286 79
Cash on hand and in bank		9,208 67		
Real estate owned		26,609 61		
Other assets		498 10		
Total assets		$85,082 21	Total liabilities	$85,082 21

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$4,938 44	Loans on mortgages and stock	$13,852 00
Installment stock—dues	8,201 00	Dues repaid — installment stock	15,777 00
Interest received	3,717 06	Salaries	600 00
Loans repaid	24,191 77	Taxes	776 87
All other receipts	4,323 55	Other expenses	444 80
		All other disbursements	4,712 48
		Balance on hand and in bank	9,208 67
Total receipts	$45,371 82	Total disbursements	$45,371 82

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	440½	$120 00	$145 48	$145 48
2	31	108 00	128 54	128 54
5	5	72 00	80 84	80 84
6	18	60 00	65 64	65 64
7	10	48 00	51 21	51 21

No. 102—SAN FRANCISCO.

MISSION HOME AND LOAN ASSOCIATION.

(Incorporated March, 1889.)

T. F. CREIGHTON, Secretary. JOHN H. GRADY, President.

Fiscal year ends March 31, 1900.

No. of series, 18. No. of shares, 1,369½.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$90,300 00	Installment stock—dues	$74,484 00
Arrearages	9,114 85	Earnings apportioned	28,170 31
On shares $3,445 00		Advance payments	207 00
On interest 3,767 85		Overdrafts and bills payable	8,393 22
On premiums 1,902 00		Reserve and undivided profits	4,398 57
Real estate owned	15,846 44		
Other assets	391 81		
Total assets	$115,653 10	Total liabilities	$115,653 10

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$20,554 25	Overdrafts and bills payable	$2,664 08
Interest received	8,170 24	Loans on mortgages and stock	1,600 00
Premiums received	3,687 56	Interest paid	228 25
Fines received	172 95	Dues repaid — installment stock	44,771 75
Fees received	31 55	Profits repaid — installment stock	20,216 98
Loans repaid	40,650 00	Salaries	1,682 50
Overdrafts and bills payable	8,393 22	Taxes	1,037 85
All other receipts	4,443 30	Other expenses	396 63
		All other disbursements	13,505 03
Total receipts	$86,103 07	Total disbursements	$86,103 07

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
123	$123 00	$194 87	$186 04
108	108 00	163 40	156 60
96	96 00	139 78	134 40
84	84 00	117 51	113 40
72	72 00	96 62	91 44
60	60 00	77 10	72 00
48	48 00	58 94	54 72
36	36 00	42 15	39 24
24	24 00	26 73	25 44
12	12 00	12 68	12 36

No. 103—SAN FRANCISCO.

MONARCH MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated May, 1891.)

R. MOHR, Secretary. D. BECKER, President.

Fiscal year ends May 14, 1900.

No. of series, 8. No. of shares, 880.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$47,600 00	Installment stock—dues	$56,112 00
Arrearages		1,679 76	Earnings apportioned	18,242 46
On shares	$865 00		Reserve and undivided profits	196 85
On interest	405 00			
On premiums	243 00			
On fines, etc.	166 76			
Cash on hand and in bank		5,474 12		
Real estate owned		12,883 68		
Other assets		6,913 75		
Total assets		$74,551 31	Total liabilities	$74,551 31

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,029 79	Overdrafts and bills payable	$5,000 00
Installment stock—dues	11,948 00	Loans on mortgages and stock	6,300 00
Interest received	3,944 20	Interest paid	89 04
Premiums received	1,895 75	Dues repaid — installment stock	9,621 00
Fines received	286 60	Profits repaid — installment stock	1,732 12
Fees received	7 40	Salaries	720 00
Loans repaid	17,900 00	Taxes	713 76
All other receipts	2,556 06	Other expenses	214 15
		All other disbursements	9,703 61
		Balance on hand and in bank	5,474 12
Total receipts	$39,567 80	Total disbursements	$39,567 80

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	220	$108 00	$162 30	$148 72
2	16	96 00	135 77	133 83
3	58	84 00	112 21	102 33
4	38	72 00	91 10	33 46
5	74	60 00	72 04	66 62
6	290	48 00	54 88	51 44
7	110	36 00	39 51	37 75
9	74	12 00	12 35	12 17

No. 104—SAN FRANCISCO.

MUTUAL SAVINGS FUND LOAN AND BUILDING ASSOCIATION.

(Incorporated June 4, 1883.)

JOHN W. BUTLER, Secretary. JOHN D. MCKEE, President.

Fiscal year ends June 30, 1899.

No. of series, 20. No. of shares, 2,225.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$160,634 30	Installment stock—dues	$126,012 00
Arrearages		2,092 00	Earnings apportioned	54,109 44
On shares	$861 00		Advance payments	2,382 00
On interest	1,071 50		Overdrafts and bills payable	430 00
On premiums	159 50		Reserve and undivided profits	3,739 21
Cash on hand and in bank		20,125 21	Unearned premiums	3,267 00
Real estate owned		6,779 07		
Other assets		309 07		
Total assets		$189,939 65	Total liabilities	$189,939 65

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$6,623 51	Overdrafts and bills payable	$6,710 00
Installment stock—dues	27,322 00	Loans on mortgages and stock	12,133 60
Interest received	12,255 66	Interest paid	412 40
Premiums received	1,799 40	Dues repaid — installment stock	17,472 00
Fees received	32 30	Profits repaid — installment stock	9,370 62
Loans repaid	24,313 70	Salaries	1,405 25
Overdrafts and bills payable	3,505 00	Taxes	2,213 99
All other receipts	177 52	Other expenses	438 75
		All other disbursements	5,747 27
		Balance on hand and in bank	20,125 21
Total receipts	$76,029 09	Total disbursements	$76,029 09

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
120	$120 00	$194 37	$194 37
108	108 00	168 18	136 80
96	96 00	143 50	118 68
84	84 00	120 31	101 28
72	72 00	98 62	84 60
60	60 00	78 43	68 64
48	48 00	59 75	53 40
36	36 00	42 56	38 88
24	24 00	26 87	25 08
12	12 00	12 68	12 00

No. 105—SAN FRANCISCO.

NATIONAL HOME AND LOAN ASSOCIATION.

(Incorporated November 5, 1885.)

N. Schlesinger, Secretary. August Drucker, President.

Fiscal year ends January 31, 1900.

No. of series, 8. No. of shares, 1,030.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$82,300 00	Installment stock—dues	$58,360 00
Arrearages		4,293 48	Earnings apportioned	10,213 20
On shares	$1,762 00		Overdrafts and bills payable	28,533 73
On interest	1,931 41		Reserve and undivided profits	2,279 19
On premiums	600 00		Other liabilities	476 08
Real estate owned		12,711 42		
Other assets		557 30		
Total assets		$99,862 20	Total liabilities	$99,862 20

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$12,125 00	Overdrafts and bills payable	$32,762 50
Interest received	6,044 12	Interest paid	3,096 43
Fees received	2 50	Dues repaid — installment stock	13,772 00
Loans repaid	14,000 00	Profits repaid — installment stock	5,036 93
Overdrafts and bills payable	28,533 73	Salaries	1,537 50
All other receipts	1,408 76	Taxes	1,290 42
		Other expenses	150 68
		All other disbursements	4,467 65
Total receipts	$62,114 11	Total disbursements	$62,114 11

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	85	$136 00	$200 45	$200 45
3	25	84 00	96 65	92 85
4	152	72 00	81 31	77 59
5	297	60 00	66 48	63 24
6	145	48 00	52 16	49 66
7	101	36 00	38 36	36 71
8	226	24 00	25 06	24 21
9	5	12 00	12 27	12 03

No. 106—SAN FRANCISCO.

OCCIDENTAL LOAN ASSOCIATION.

(Incorporated August 25, 1885.)

E. GUNZBURGER, Secretary. GEO. W. DIXON, President.

Fiscal year ends September 4, 1899.

No. of series, 11. No. of shares, 1,213.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$135,000 00	Installment stock—dues	$101,160 00
Arrearages		5,802 60	Earnings apportioned	30,097 84
On shares	$3,397 00		Advance payments	22 35
On interest	2,306 80		Overdrafts and bills payable	17,382 32
On premiums	98 80		Reserve and undivided profits	5,903 06
Real estate owned		26,389 83	Unearned premiums	3,264 98
			Other liabilities	9,361 88
Total assets		$167,192 43	Total liabilities	$167,192 43

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$16,981 00	Overdrafts and bills payable	$39,041 65
Interest received	10,637 30	Loans on mortgages and stock	1,723 62
Premiums received	462 70	Interest paid	1,865 30
Fines received	278 15	Dues repaid — installment stock	24,106 00
Fees received	8 70	Profits repaid — installment stock	9,014 57
Loans repaid	48,300 00	Salaries	1,764 00
Overdrafts and bills payable	17,382 32	Taxes	1,631 11
All other receipts	5,166 90	Other expenses	272 75
		All other disbursements	19,798 07
Total receipts	$99,217 07	Total disbursements	$99,217 07

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	133	$132 00	$193 30	$168 78
5	159	120 00	166 96	148 18
6	156	108 00	142 81	128 89
7	174	96 00	120 58	110 75
8	151	84 00	101 40	94 44
9	89	72 00	84 15	78 08
10	13	60 00	68 17	64 09
11	138	48 00	53 13	50 56
12	30	36 00	38 86	37 43
13	113	24 00	25 27	24 64
14	57	12 00	12 33	12 17

No. 107—SAN FRANCISCO.

PACIFIC COAST LOAN ASSOCIATION.

(Incorporated October 3, 1890.)

CHARLES E. NAYLOR, Secretary. MARK SHELDON, President.

Fiscal year ends September 30, 1899.

No. of series, 11. No. of shares, 970.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$68,700 00	Installment stock—dues	$63,474 00
Arrearages		490 35	Earnings apportioned	25,011 78
On shares	$190 00		Advance payments	40 00
On interest	227 80		Reserve and undivided profits	1,886 10
On premiums	53 55		Unearned premiums	517 20
Cash on hand and in bank		8,234 37		
Real estate owned		11,764 25		
Other assets		1,740 11		
Total assets		$90,929 08	Total liabilities	$90,929 08

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$324 39	Loans on mortgages and stock	$11,500 00
Installment stock—dues	11,643 00	Interest paid	47 05
Interest received	5,807 22	Dues repaid — installment stock	11,118 00
Premiums received	1,664 00	Profits repaid — installment stock	3,081 11
Fines received	105 80	Salaries	960 00
Fees received	18 50	Taxes	1,096 42
Loans repaid	19,700 00	Other expenses	240 25
All other receipts	744 99	All other disbursements	3,730 70
		Balance on hand and in bank	8,234 37
Total receipts	$40,007 90	Total disbursements	$40,007 90

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	311	$108 00	$159 03	$152 00
2	100	96 00	136 32	126 24
3	95	84 00	114 87	105 60
4	21	72 00	94 68	86 74
5	29	60 00	75 75	69 45
6	53	48 00	58 08	53 04
7	66	36 00	41 67	38 84
8	93	24 00	26 52	25 44
9	47	18 00	19 41	18 81
10	21	12 00	12 63	12 36
11	134	6 00	6 15	6 00

No. 108—SAN FRANCISCO.

PACIFIC LOAN ASSOCIATION.

(Incorporated December 8, 1884.)

E. GUNZBURGER, Secretary. D. J. MURPHY, President.

Fiscal year ends December 5, 1899.

No. of series, 10. No. of shares, 1,545.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$142,575 00	Installment stock—dues	$146,700 00
Arrearages		7,855 65	Earnings apportioned	37,995 96
On shares	$4,660 00		Advance payments	83 00
On interest	3,195 65		Overdrafts and bills payable	27,464 60
Cash on hand and in bank		3,083 91	Reserve and undivided profits	9,026 80
Real estate owned		70,054 47	Unearned premiums	3,657 10
Other assets		1,358 43		
Total assets		$224,927 46	Total liabilities	$224,927 46

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$5,180 01	Overdrafts and bills payable	$4,233 67
Installment stock—dues	18,890 00	Loans on mortgages and stock	6,775 00
Interest received	10,082 40	Interest paid	1,219 46
Premiums received	120 00	Dues repaid — installment stock	39,906 00
Fees received	8 60	Profits repaid — installment stock	12,516 38
Loans repaid	31,800 00	Salaries	1,735 00
Overdrafts and bills payable	10,464 60	Taxes	1,906 88
All other receipts	4,224 55	Other expenses	451 49
		All other disbursements	8,942 37
		Balance on hand and in bank	3,083 91
Total receipts	$80,770 16	Total disbursements	$80,770 16

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
5	227	$132 00	$184 83	$163 70
6	191	120 00	159 69	143 81
7	280	108 00	137 12	125 47
8	284	96 00	115 43	107 65
9	263	84 00	97 41	92 05
10	15	72 00	81 04	76 52
11	90	60 00	66 08	63 04
12	138	48 00	51 65	49 82
13	36	24 00	24 82	24 41
14	21	12 00	12 39	12 20

No. 109—SAN FRANCISCO.

PACIFIC MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated August 31, 1891.)

JOHN R. HILLMAN, Secretary. ROLLA V. WATT, President.

Fiscal year ends August 31, 1899.

No. of series, 15. No. of shares, 995.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$58,100 00	Installment stock—dues	$50,046 00
Arrearages	448 36	Earnings apportioned	11,541 27
On shares ... $309 00		Advance payments	440 00
On interest ... 139 36		Overdrafts and bills payable	6,134 48
Cash on hand and in bank	82 03	Reserve and undivided profits	543 31
Real estate owned	8,849 05	Unearned premiums	2,873 25
Other assets	4,578 86	Other liabilities	479 99
Total assets	$72,058 30	Total liabilities	$72,058 30

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$59 95	Overdrafts and bills payable	$4,394 00
Installment stock—dues	13,089 00	Loans on mortgages and stock	2,700 00
Interest received	4,535 14	Interest paid	565 86
Premiums received	405 00	Dues repaid — installment stock	12,637 00
Fines received	78 76	Profits repaid—installment stock	2,941 16
Fees received	15 40	Salaries	667 50
Loans repaid	3,800 00	Taxes	633 44
Overdrafts and bills payable	4,371 41	Other expenses	126 01
All other receipts	992 07	All other disbursements	2,599 73
		Balance on hand and in bank	82 03
Total receipts	$27,346 73	Total disbursements	$27,346 73

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	148	$96 00	$128 45	$128 45
2	33	90 00	117 92	117 92
3	126	84 00	107 46	107 46
4	11	78 00	97 78	97 78
5	15	72 00	88 46	88 46
6	20	66 00	79 46	79 46
7	60	60 00	70 80	70 80
8	26	54 00	62 50	62 50
9	92	48 00	54 45	54 45
10	47	42 00	46 76	45 57
12	50	30 00	32 37	31 18
13	155	24 00	25 50	24 75
14	85	18 00	18 85	18 00
15	20	12 00	12 38	12 00
16	107	6 00	6 10	6 00

No. 110—SAN FRANCISCO.

PROVIDENT MUTUAL LOAN ASSOCIATION.

(Incorporated September 20, 1887.)

D. HIRSCHFELD, Secretary. SAMUEL WEIL, President.

Fiscal year ends September 30, 1899.

No. of series, 12. No. of shares, 1,679.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$127,700 00	Installment stock—dues	$96,654 00
Arrearages		385 20	Earnings apportioned	30,529 84
On shares	$144 00		Advance payments	15 00
On interest	169 20		Reserve and undivided profits	3,824 75
On premiums	72 00		Unearned premiums	2,730 00
Cash on hand and in bank		9,113 84	Other liabilities	12,515 00
Real estate owned		8,108 27		
Other assets		961 28		
Total assets		$146,268 59	Total liabilities	$146,268 59

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$4,996 34	Loans on mortgages and stock	$29,864 00
Installment stock—dues	21,052 00	Interest paid	4 23
Interest received	9,332 67	Dues repaid — installment stock	27,283 00
Premiums received	3,149 10	Profits repaid — installment stock	9,480 73
Fines received	28 65	Salaries	1,790 00
Fees received	31 60	Taxes	1,520 93
Loans repaid	37,650 00	Other expenses	635 00
All other receipts	3,933 10	All other disbursements	481 73
		Balance on hand and in bank	9,113 84
Total receipts	$80,173 46	Total disbursements	$80,173 46

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	56	$132 00	$200 28	$200 28
3	40	120 00	176 47	174 00
4	162	108 00	153 79	149 00
5	95	96 00	132 22	127 00
6	201	84 00	111 77	106 00
7	97	72 00	92 44	87 00
8	224	60 00	74 23	69 00
9	143	48 00	57 14	53 75
10	207	36 00	41 18	39 25
11	150	24 00	26 33	25 40
12	133	12 00	12 60	12 30
13	171	6 00	6 16	6 00

No. 111—SAN FRANCISCO.

PRUDENCE BUILDING AND LOAN ASSOCIATION.

(Incorporated March 18, 1891.)

J. M. ELLIS, Secretary. A. H. LISSAK, President.

Fiscal year ends March 31, 1900.

No. of series, 10. No. of shares, 959.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$65,750 00	Installment stock—dues	$57,876 00
Arrearages		240 05	Earnings apportioned	19,057 35
On shares	$225 00		Overdrafts and bills payable	2,133 53
On interest	7 55		Reserve and undivided profits	3,809 23
On premiums	7 50		Unearned premiums	266 30
Cash on hand and in bank		306 55		
Real estate owned		16,758 31		
Other assets		87 50		
Total assets		$83,142 41	Total liabilities	$83,142 41

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$5,210 52	Interest paid	$397 52
Installment stock—dues	12,603 00	Dues repaid — installment stock	36,967 60
Interest received	4,919 45	Profits repaid — installment stock	9,991 22
Premiums received	412 50	Salaries	1,339 00
Fines received	10 50	Taxes	698 06
Fees received	2 00	Other expenses	137 38
Loans repaid	21,100 00	All other disbursements	749 87
Overdrafts and bills payable	2,133 53	Balance on hand and in bank	306 55
All other receipts	4,195 70		
Total receipts	$50,587 20	Total disbursements	$50,587 20

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	276	$108 00	$153 60	Dues and 65% to 75% of profits.
2	34	102 00	142 24	
3	63	96 00	130 91	
4	15	84 00	109 71	
5	32	72 00	89 35	
6	80	60 00	71 41	
7	55	48 00	55 00	
8	76	36 00	40 12	
9	73	24 00	26 20	
10	255	12 00	12 72	

No. 112—SAN FRANCISCO.

PROGRESS MUTUAL LOAN ASSOCIATION.

(Incorporated January, 1895.)

D. HIRSCHFELD, Secretary. E. K. CHAPMAN, President.

Fiscal year ends December 31, 1899.

No. of series, 5. No. of shares, 803.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$44,220 00	Installment stock—dues	$40,200 00
Arrearages		839 77	Earnings apportioned	8,115 97
On shares	$352 00		Advance payments	50 00
On interest	344 27		Reserve and undivided profits	606 00
On premiums	143 50		Unearned premiums	102 00
Cash on hand and in bank		3,978 47		
Other assets		35 73		
Total assets		$49,073 97	Total liabilities	$49,073 97

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,497 49	Loans on mortgages and stock	$6,750 00
Installment stock—dues	10,859 00	Interest paid	78 05
Paid-up and prepaid stock	1,000 00	Dues repaid — installment stock	12,966 00
Interest received	3,253 71	Profits repaid — installment stock	1,175 37
Premiums received	1,292 55	Paid-up and prepaid stock	1,000 00
Fines received	36 50	Salaries	720 00
Fees received	1 30	Taxes	615 66
Loans repaid	9,305 00	Other expenses	44 80
All other receipts	82 80	Balance on hand and in bank	3,978 47
Total receipts	$27,328 35	Total disbursements	$27,328 35

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	508	$60 00	$73 40	$69 75
2	55	48 00	56 61	29 76
3	123	36 00	40 87	39 24
4	104	24 00	26 20	25 45
5	13	12 00	12 57	12 30

No. 113—SAN FRANCISCO.

RICHMOND MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated August, 1897.)

W. H. DAVIS, Secretary. H. P. UMBSEN, President.

Fiscal year ends July 31, 1899.

No. of series, 4. No. of shares, 565.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$18,975 00	Installment stock—dues	$10,998 00
Arrearages		147 40	Earnings apportioned	968 20
On shares	$74 00		Advance payments	600 00
On interest	51 40		Overdrafts and bills payable	6,553 87
On premiums	22 00		Reserve and undivided profits	2 33
Total assets		$19,122 40	Total liabilities	$19,122 40

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$7,107 00	Overdrafts and bills payable	$9,078 96
Interest received	1,195 95	Loans on mortgages and stock	2,325 00
Premiums received	513 15	Interest paid	610 99
Fines received	3 90	Dues repaid — installment stock	95 00
Fees received	11 90	Profits repaid — installment stock	4 25
Overdrafts and bills payable	3,753 87	Salaries	300 00
		Taxes	132 41
		Other expenses	39 16
Total receipts	$12,585 77	Total disbursements	$12,585 77

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	298	$24 00	$26 40	$25 50
2	146	18 00	19 37	18 85
3	82	12 00	12 57	12 39
4	39	6 00	6 16	6 10

No. 114—SAN FRANCISCO.

SAFETY MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated May 12, 1894.)

C. A. Buckbee, Secretary. E. W. Newhall, President.

Fiscal year ends April 30, 1900.

No. of series, 12. No. of shares, 1,730¾.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$72,979 33	Installment stock—dues	$63,010 50
Arrearages		880 31	Earnings apportioned	11,744 34
On shares	$313 00		Advance payments	413 16
On interest	417 56		Overdrafts and bills payable	6,392 05
On premiums	149 75		Reserve and undivided profits	509 64
Cash on hand and in bank		289 80	Other liabilities	2,700 00
Real estate owned		10,604 00		
Other assets		16 25		
Total assets		$84,769 69	Total liabilities	$84,769 69

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$6,823 95	Loans on mortgages and stock	$38,788 00
Installment stock—dues	22,069 00	Interest paid	92 12
Interest received	5,702 65	Dues repaid — installment stock	25,628 00
Premiums received	2,235 25	Profits repaid—installment stock	4,682 13
Fines received	195 45	Salaries	1,210 00
Fees received	41 65	Taxes	853 70
Loans repaid	32,210 00	Other expenses	237 90
Overdrafts and bills payable	6,392 05	All other disbursements	4,401 44
All other receipts	513 09	Balance on hand and in bank	289 80
Total receipts	$76,183 09	Total disbursements	$76,183 09

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	549	305	$72 00	$91 22	$84 78
2	165	110	66 00	81 56	76 72
3	85	50	60 00	72 39	68 85
4	124½	119½	54 00	63 75	61 15
5	130½	124	48 00	55 43	53 62
6	97	62	42 00	47 49	46 30
7	200	139	36 00	39 93	39 15
8	87	77	30 00	32 67	32 17
9	131½	101½	24 00	25 67	25 38
10	128	98	18 00	18 86	18 76
11		166½	12 00	12 44	12 32
12		378¼	6 00	6 12	6 00

No. 115—SAN FRANCISCO.

SAN FRANCISCO MUTUAL LOAN ASSOCIATION.

(Incorporated October 28, 1882.)

A. SBARBORO, Secretary. THOMAS J. WELSH, President.

Fiscal year ends October 31, 1899.

No. of series, 14. No. of shares, 1,339½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$147,996 69	Installment stock—dues	$127,000 50
Arrearages		2,283 95	Earnings apportioned	33,869 59
On shares	$1,005 00		Advance payments	147 00
On interest	891 75		Overdrafts and bills payable	5,000 00
On premiums	9 40		Reserve and undivided profits	354 01
On fines, etc.	377 80		Other liabilities	6,524 75
Cash on hand and in bank		3,377 15		
Real estate owned		18,531 91		
Other assets		706 15		
Total assets		$172,895 85	Total liabilities	$172,895 85

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,697 91	Loans on mortgages and stock	$2,600 00
Installment stock—dues	14,861 50	Interest paid	1,323 06
Interest received	9,577 79	Dues repaid — installment stock	39,443 00
Premiums received	506 00	Profits repaid — installment stock	10,105 26
Fines received	124 65	Salaries	2,400 00
Fees received	12 25	Taxes	1,884 36
Loans repaid	36,920 29	Other expenses	510 70
Overdrafts and bills payable	5,000 00	All other disbursements	10,686 99
All other receipts	3,630 13	Balance on hand and in bank	3,377 15
Total receipts	$72,330 52	Total disbursements	$72,330 52

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	10	$135 00	$200 00	$200 00
5	150½	141 00	200 00	200 00
6	134½	144 00	195 96	182 97
7	111½	132 00	173 50	163 12
8	174½	120 00	151 85	143 88
9	132	108 00	131 15	125 36
10	121	96 00	111 90	107 92
11	128	84 00	94 84	92 10
12	52	72 00	79 52	76 51
13	16½	60 00	64 51	62 70
14	55	48 00	50 32	49 16
15	65	36 00	37 58	36 79
16	66½	24 00	24 95	24 47
17	122½	12 00	12 36	12 18

No. 116—SAN FRANCISCO.

SAN FRANCISCO AND OAKLAND MUTUAL LOAN ASSOCIATION.

(Incorporated January 3, 1889.)

A. SBARBORO, Secretary. THOMAS J. WELSH, President.

Fiscal year ends December 31, 1899.

No. of series, 11. No. of shares, 2,439.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$165,295 80	Installment stock—dues	$180,552 00
Arrearages		949 75	Earnings apportioned	47,490 46
On shares	$520 00		Advance payments	82 00
On interest	274 15		Reserve and undivided profits	3,934 48
On premiums	4 00		Other liabilities	1,443 49
On fines, etc.	151 60			
Cash on hand and in bank		48,775 20		
Real estate owned		17,665 16		
Other assets		816 52		
Total assets		$233,502 43	Total liabilities	$233,502 43

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$24,974 46	Loans on mortgages and stock	$6,750 00
Installment stock—dues	31,918 00	Interest paid	3 60
Interest received	11,327 24	Dues repaid — installment stock	41,150 50
Premiums received	1,934 10	Profits repaid — installment stock	7,713 21
Fines received	35 70	Salaries	2,400 00
Fees received	31 30	Taxes	2,261 34
Loans repaid	40,530 00	Other expenses	511 53
Overdrafts and bills payable	4,535 58	All other disbursements	5,721 00
		Balance on hand and in bank	48,775 20
Total receipts	$115,286 38	Total disbursements	$115,286 38

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	473	383	$132 00	$184 06	$171 04
2	264½	200½	120 00	161 91	151 43
3	207½	172½	108 00	139 98	131 98
4	251	206	96 00	120 55	114 91
5	258	199½	84 00	101 02	96 76
6	116	99	72 00	83 76	79 05
7	327	239½	60 00	67 41	64 44
8	271	251	48 00	52 63	50 31
9	327½	207½	36 00	38 74	37 37
10	384½	332½	24 00	25 31	24 65
11	----------	148	12 00	12 50	12 25

No. 117—SAN FRANCISCO.

SAN FRANCISCO HOME MUTUAL LOAN ASSOCIATION.

(Incorporated November 8, 1890.)

A. SBARBORO, Secretary. THOMAS J. WELSH, President.

Fiscal year ends October 31, 1899.

No. of series, 9. No. of shares, 982½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$70,637 18	Installment stock—dues	$70,458 00
Arrearages		711 60	Earnings apportioned	14,339 81
On shares	$490 50		Advance payments	90 00
On interest	135 50		Reserve and undivided profits	2,271 42
On fines, etc.	85 60		Other liabilities	403 89
Cash on hand and in bank		10,660 37		
Real estate owned		5,347 49		
Other assets		206 48		
Total assets		$87,563 12	Total liabilities	$87,563 12

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$10,191 94	Loans on mortgages and stock	$2,450 00
Installment stock—dues	12,350 50	Interest paid	19 05
Interest received	4,565 70	Dues repaid — installment stock	$20,412 50
Premiums received	461 65	Profits repaid — installment stock	2,905 84
Fines received	33 10	Salaries	900 00
Fees received	6 10	Taxes	1,132 59
Loans repaid	11,408 16	Other expenses	438 42
All other receipts	359 53	All other disbursements	457 91
		Balance on hand and in bank	10,660 37
Total receipts	$39,376 68	Total disbursements	$39,376 68

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	201	$108 00	$138 90	$131 17
2	169	96 00	118 98	113 23
3	108½	84 00	100 27	96 20
4	85	72 00	82 90	78 54
5	138	60 00	66 82	64 09
6	100	48 00	51 88	49 94
7	45	36 00	38 34	37 17
8	80	24 00	25 18	24 59
9	56	12 00	12 44	12 22

No. 118—SAN FRANCISCO.

SECURITY LOAN ASSOCIATION.

(Incorporated April 17, 1888.)

H. L. Rea, Secretary. Louis Metzger, President.

Fiscal year ends April 30, 1900.

No. of series, 5. No. of shares, 352.

Financial Statement.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$26,130 77	Installment stock—dues	$42,540 00
Arrearages	6,270 00	Reserve and undivided profits	13,371 79
On shares $6,270 00		Unearned premiums	886 43
Cash on hand and in bank	3,218 46		
Real estate owned	13,400 00		
Other assets	7,778 99		
Total assets	$56,798 22	Total liabilities	$56,798 22

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$3,505 00	Overdrafts and bills payable	$1,064 49
Interest received	1,562 60	Loans on mortgages and stock	4,140 00
Loans repaid	13,445 73	Interest paid	14 11
All other receipts	6,981 52	Dues repaid — installment stock	11,425 00
		Salaries	747 50
		Taxes	460 60
		Other expenses	48 40
		All other disbursements	4,376 29
		Balance on hand and in bank	3,218 46
Total receipts	$25,494 85	Total disbursements	$25,494 85

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	316	231	$144 00	$144 00	$144 00
5	6	6	96 00	96 00	96 00
6	100	100	84 00	84 00	84 00
10	10	10	36 00	36 00	36 00
11	5	5	24 00	24 00	24 00

No. 119—SAN FRANCISCO.

TRIUMPH LOAN ASSOCIATION.

(Incorporated January 30, 1891.)

JOHN BRUCKMAN, Secretary. A. STEINBERGER, President.

Fiscal year ends January 31, 1900.

No. of series, 16. No. of shares, 911.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$41,050 00	Installment stock—dues	$53,562 00
Arrearages		50 50	Earnings apportioned	13,168 40
On shares	$25 00		Reserve and undivided profits	9,006 94
On interest	14 75		Unearned premiums	1,068 00
On premiums	6 25			
On fines, etc.	4 50			
Cash on hand and in bank		1,192 08		
Real estate owned		34,512 76		
Total assets		$76,805 34	Total liabilities	$76,805 34

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$3,552 62	Interest paid	$161 86
Installment stock—dues	12,477 00	Dues repaid — installment stock	28,181 00
Interest received	4,364 38	Profits repaid — installment stock	6,718 15
Premiums received	1,585 60	Salaries	1,470 00
Fines	291 35	Taxes	377 43
Fees received	10 50	Other expenses	106 15
Loans repaid	28,050 00	All other disbursements	16,428 82
All other receipts	4,304 04	Balance on hand and in bank	1,192 08
Total receipts	$54,635 49	Total disbursements	$54,635 49

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	70	$108 00	$145 66	$144 00
3	137	96 00	125 76	124 00
4	23	90 00	116 15	113 50
5	122	84 00	106 78	103 00
7	10	72 00	88 74	85 00
8	45	66 00	80 06	76 75
9	8	60 00	71 62	69 00
10	105	54 00	64 41	60 50
11	90	48 00	55 43	53 00
12	10	42 00	47 69	45 65
13	20	36 00	40 18	38 70
14	34	30 00	32 90	31 85
15	130	24 00	25 86	25 20
16	12	18 00	16 82	16 50
17	55	12 00	12 46	12 25
18	40	6 00	6 11	6 00

No. 120—SAN FRANCISCO.

UNION LOAN ASSOCIATION.

(Incorporated May 6, 1881.)

E. GUNZBURGER, Secretary. ISAAC UPHAM, President.

Fiscal year ends May 7, 1900.

No. of series, 11. No. of shares, 688.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$59,400 00	Installment stock—dues	$45,972 00
Arrearages	1,385 75	Earnings apportioned	12,163 01
On shares $643 00		Advance payments	128 35
On interest 682 75		Overdrafts and bills payable	14,181 26
On premiums 60 00		Reserve and undivided profits	2,035 73
Real estate owned	13,701 23	Other liabilities	186 65
Other assets	180 02		
Total assets	$74,667 00	Total liabilities	$74,667 00

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,031 04	Overdrafts and bills payable	$1,000 00
Installment stock—dues	11,546 00	Loans on mortgages and stock	14,500 00
Interest received	6,267 79	Interest paid	486 03
Premiums received	690 75	Dues repaid — installment stock	48,602 00
Fines received	227 47	Profits repaid — installment stock	16,318 59
Fees received	19 00	Salaries	1,290 00
Loans repaid	56,050 00	Taxes	892 26
Overdrafts and bills payable	10,161 26	Other expenses	265 57
All other receipts	1,027 60	All other disbursements	4,666 46
Total receipts	$88,020 91	Total disbursements	$88,020 91

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
9	113	$132 00	$180 88	$171 10
10	78	120 00	157 94	150 35
11	79	108 00	137 41	125 65
12	5	96 00	118 91	107 45
13	2	84 00	101 45	92 72
14	33	72 00	84 61	78 30
15	7	60 00	68 67	61 73
16	60	48 00	53 13	49 05
17	118	36 00	38 86	36 57
18	23	24 00	25 27	24 75
19	170	12 00	12 33	12 07

No. 121—SAN FRANCISCO.

WEST SHORE MUTUAL LOAN ASSOCIATION.

(Incorporated August 4, 1890.)

H. K. STARKWEATHER, Secretary. D. D. STARK, President.

Fiscal year ends January 14, 1900.

No. of series, none. No. of shares, 438.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$9,720 00	Installment stock—dues	$5,727 35
Cash on hand and in bank	1,283 32	Earnings apportioned	198 45
Other assets	299 22	Overdrafts and bills payable	1,743 50
		Reserve and undivided profits	11 39
		Other liabilities	3,621 85
Total assets	$11,302 54	Total liabilities	$11,302 54

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$6,507 35	Loans on mortgages and stock	$6,138 15
Interest received	344 55	Dues repaid — installment stock	780 00
Fees received	24 00	Salaries	150 00
Loans repaid	40 00	Other expenses	43 16
All other receipts	2,364 25	All other disbursements	885 52
		Balance on hand and in bank	1,283 32
Total receipts	$9,280 15	Total disbursements	$9,280 15

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
12	$12 00	$12 43	$12 43

No. 122—SAN FRANCISCO.

WESTERN LOAN ASSOCIATION.

(Incorporated November 12, 1886.)

E. GUNZBURGER, Secretary. D. SAMUELS, President.

Fiscal year ends November 18, 1899.

No. of series, 10. No. of shares, 1,029.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$78,250 00	Installment stock—dues	$78,180 00
Arrearages	5,824 60	Earnings apportioned	28,147 70
On shares $3,121 00		Advance payments	215 00
On interest 1,786 35		Reserve and undivided profits	5,011 21
On premiums 907 25		Other liabilities	1,650 00
Cash on hand and in bank	5,787 23		
Real estate owned	23,145 45		
Other assets	196 63		
Total assets	$113,203 91	Total liabilities	$113,203 91

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,152 48	Loans on mortgages and stock	$8,850 00
Installment stock—dues	15,616 00	Dues repaid — installment stock	26,594 00
Interest received	7,255 30	Profits repaid — installment stock	9,769 90
Premiums received	3,050 80	Salaries	1,640 00
Fines received	14 30	Taxes	1,206 46
Fees received	10 60	Other expenses	279 12
Loans repaid	36,650 00	All other disbursements	17,593 23
All other receipts	7,970 46	Balance on hand and in bank	5,787 23
Total receipts	$71,719 94	Total disbursements	$71,719 94

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	116	$120 00	$175 76	$161 82
5	179	108 00	153 20	139 64
6	184	96 00	131 76	119 24
7	166	84 00	111 41	100 44
8	56	72 00	92 18	82 09
9	25	60 00	74 05	67 03
10	35	48 00	57 03	52 52
11	76	36 00	41 11	38 55
12	95	24 00	26 30	25 15
13	91	12 00	12 60	12 30

No. 123—SAN FRANCISCO.

CALIFORNIA HOME BUILDING-LOAN COMPANY.

(Incorporated July 8, 1889.)

PERRY B. ROBERTS, Secretary. C. O. PERRY, President.

Fiscal year ends March 6, 1900.

No. of series, 5. No. of shares, 5.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Cash on hand and in bank	$521 00	Paid-up and prepaid stock and profits	$521 00
Total assets	$521 00	Total liabilities	$521 00

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$690 22	Dues repaid — installment stock	$512 00
Loans repaid	575 00	Profits repaid — installment stock	56 22
		All other disbursements	176 00
		Balance on hand and in bank	521 00
Total receipts	$1,265 22	Total disbursements	$1,265 22

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Series.	Book Value per Series.	Withdrawal Value.
	5	$521 00	$521 00	$521 00

No. 124—SAN FRANCISCO.

CALIFORNIA GUARANTEE INVESTMENT COMPANY.

(Incorporated August 2, 1890.)

JNO. W. BUTLER, Secretary. H. M. A. MILLER, President.

Fiscal year ends August 31, 1899.

No. of series, 28. No. of shares, 2,123.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$101,237 83	Installment stock—dues	$25,764 44
Arrearages		953 26	Paid-up and prepaid stock	159,650 00
On interest	$826 90		Earnings apportioned	9,154 98
On premiums	126 36		Overdrafts and bills payable	1.672 76
Cash on hand and in bank		300 00	Other liabilities	2,328 61
Real estate owned		86,925 42		
Other assets		9,154 28		
Total assets		$198,570 79	Total liabilities	$198,570 79

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$207 81	Loans on mortgages and stock	$9,912 32
Installment stock—dues	4,487 64	Interest paid	2,409 95
Paid-up and prepaid stock	2,500 00	Dues repaid — installment stock	45,883 16
Interest received	6,363 47	Profits repaid — installment stock	18,407 20
Premiums received	1,526 72	Paid-up and prepaid stock and dividends	34,327 70
Fines received	152 10	Salaries	3,506 64
Loans repaid	92,587 76	Taxes	3,762 58
Overdrafts and bills payable	1,672 76	Other expenses	1,571 62
All other receipts	30,122 81	All other disbursements	19,539 90
		Balance on hand and in bank	300 00
Total receipts	$139,621 07	Total disbursements	$139,621 07

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Loan Fund Dues.	Book Value per Share.	Withdrawal Value.
108	$64 80	$56 16	$81 72	$75 32
96	57 60	49 92	66 15	62 09
84	50 40	43 68	54 00	51 42
81	48 60	42 12	51 38	49 07

No. 125—SAN FRANCISCO.

CONTINENTAL BUILDING AND LOAN ASSOCIATION.

(Incorporated July 17, 1889.)

WILLIAM CORBIN, Secretary. EDWARD E. HILL, President.

Fiscal year ends July 31, 1899.

No. of series, none. No. of shares, 84,285.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$1,190,457 50	Installment stock—dues	$508,963 93
Arrearages	20,445 43	Paid-up and prepaid stock	439,096 61
On interest $9,375 43		Earnings apportioned	132,720 82
On premiums 11,070 00		Advance payments	15,085 06
Cash on hand and in bank	2,550 30	Overdrafts and bills payable	55,000 00
Real estate owned	56,325 28	Reserve and undivided profits	11,121 16
Other assets	52,066 63	Other liabilities	159,857 56
Total assets	$1,321,845 14	Total liabilities	$1,321,845 14

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$74 50	Overdrafts and bills payable	$42,594 75
Installment stock—dues	334,419 93	Loans on mortgages and stock	$410,002 53
Paid-up and prepaid stock	343,962 93	Interest paid	4,213 64
Interest received	49,230 00	Dues repaid — installment stock	226,392 82
Premiums received	52,097 45	Profits repaid — installment stock	21,155 64
Fines received	2,110 13	Paid-up and prepaid stock	225,485 72
Fees received	477 59	Salaries	7,970 00
Loans repaid	174,551 40	Taxes	10,938 83
Overdrafts and bills payable	35,000 00	Other expenses	35,450 88
All other receipts	93,816 64	All other disbursements	98,985 46
		Balance on hand and in bank	2,550 30
Total receipts	$1,085,740 57	Total disbursements	$1,085,740 57

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Loan Fund Dues.	Book Value per Share.	Withdrawal Value.
108	$64 80	$54 00	$98 87	$87 66
96—None in force				
84	50 40	42 00	66 83	60 62
72	43 20	36 00	52 84	48 63
60	36 00	30 00	41 50	38 72
48	28 80	24 00	30 37	28 78
36	21 60	18 00	21 57	20 68
24	14 40	12 00	13 55	13 17
12	7 20	6 00	6 36	6 18

No. 126—SAN FRANCISCO.

PACIFIC COAST SAVINGS SOCIETY.

(Incorporated January 26, 1891.)

W. P. HENRY, Secretary. WENDELL EASTON, President.

Fiscal year ends December 31, 1899.

No. of series, none. No. of shares, 17,793.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$214,768 52	Installment stock—dues	$303,407 84
Arrearages		8,233 59	Paid-up and prepaid stock	58,468 64
On interest	$6,365 61		Earnings apportioned	42,072 30
On premiums	400 00		Overdrafts and bills payable	70,000 00
On fines, etc.	1,467 98		Reserve and undivided profits	27 15
Cash on hand and in bank		49,111 93		
Real estate owned		116,544 64		
Other assets		85,317 25		
Total assets		$473,975 93	Total liabilities	$473,975 93

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$43,768 68	Overdrafts and bills payable	$30,000 00
Installment stock—dues	99,271 70	Loans on mortgages and stock	36,800 40
Paid-up and prepaid stock	6,979 11	Interest paid	5,000 00
Interest received	16,600 20	Dues repaid — installment stock	131,222 00
Premiums received	11,803 40	Profits repaid — installment stock	17,845 61
Fines received	2,010 37	Salaries	7,680 00
Loans repaid	104,884 55	Taxes	4,550 87
All other receipts	10,961 27	Other expenses	8,970 99
		All other disbursements	5,097 48
		Balance on hand and in bank	49,111 93
Total receipts	$296,279 28	Total disbursements	$296,279 28

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Loan Fund Dues.	Book Value per Share.	Withdrawal Value.
96	$57 60	$57 60	$75 07	Total dues with ¾ of profits.
84	50 40	50 40	63 04	
72	43 20	43 20	51 83	
60	36 00	36 00	42 05	
48	28 80	28 80	32 73	Total dues (less mem'r-ship fee) plus ¾ of profits.
36	21 60	21 60	23 81	
24	14 40	14 40	15 22	
12	7 20	7 20	7 39	

No. 127—SAN FRANCISCO.

PACIFIC STATES SAVINGS, LOAN, AND BUILDING COMPANY.

(Incorporated July, 1889.)

WM. PARDY, Secretary. JOHN H. WISE, President.

Fiscal year ends July 31, 1899.

No. of series, 202. No. of shares, 44,769.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$1,005,644 00	Installment stock—dues	$773,456 00
Arrearages		14,732 09	Paid-up and prepaid stock	151,957 65
On shares	$6,874 84		Earnings apportioned	241,345 59
On interest	6,089 25		Advance payments	8,194 40
On premiums	1,768 00		Reserve and undivided profits	17,583 19
Cash on hand and in bank		45,590 76	Other liabilities	17,954 69
Real estate owned		135,919 89		
Other assets		8,604 78		
Total assets		$1,210,491 52	Total liabilities	$1,210,491 52

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$70,180 56	Loans on mortgages and stock	$403,366 12
Installment stock—dues	245,149 76	Interest paid, paid-up and prepaid stock, etc.	9,376 60
Paid-up and prepaid stock	25,800 00	Dues repaid — installment stock	265,459 68
Interest received	81,084 27	Profits repaid—installment stock	91,660 49
Premiums received	23,263 84	Paid-up and prepaid stock	20,840 00
Fines received	713 05	Salaries	22,040 00
Fees received	38 00	Taxes	15,932 47
Loans repaid	437,755 72	Other expenses	11,221 77
All other receipts	98,551 87	All other disbursements	97,049 18
		Balance on hand and in bank	45,590 76
Total receipts	$982,537 07	Total disbursements	$982,537 07

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues and Expense per Shares.	Loan Fund Dues.	Book Value per Share.	Withdrawal Value.
Class "A"—108	$64 80	$56 16	$96 28	Loan Fund dues and 5% per annum to 100% of profits, according to age.
96	57 60	49 92	78 06	
84	50 40	43 68	63 26	
72	43 20	37 44	50 68	
60	36 00	31 20	39 81	
48	28 80	24 96	30 21	
36	21 60	18 72	21 38	
24	14 40	12 48	13 62	
12	7 20	6 24	6 54	
Class "C"— 96	57 60	57 60	84 29	
84	50 40	50 40	69 47	
72	43 20	43 20	56 26	
60	36 00	36 00	44 45	
48	28 80	28 80	33 90	
36	21 60	21 60	24 36	
24	14 40	14 40	15 61	
12	7 20	7 20	7 50	

No. 128—SAN FRANCISCO.

RENTERS COÖPERATIVE INVESTMENT COMPANY.

(Incorporated November 24, 1890.)

GRANT CORDREY, Secretary. GEO. M. PERINE, President.

Fiscal year ends December 31, 1899.

No. of series, 101. No. of shares, 24,460.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$483,505 00	Installment stock—dues	$265,214 00
Arrearages		6,557 40	Paid-up and prepaid stock	129,240 44
On shares	$4,220 80		Earnings apportioned	62,431 36
On interest	1,072 40		Advance payments	3,277 81
On premiums	1,264 20		Overdrafts and bills payable	25,274 50
Real estate owned		10,442 25	Reserve and undivided profits	4,110 69
Other assets		7,988 56	Other liabilities	18,944 41
Total assets		$508,493 21	Total liabilities	$508,493 21

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$123,976 28	Overdrafts and bills payable	$38,705 93
Paid-up and prepaid stock	76,550 00	Loans on mortgages and stock	218,759 56
Interest received	24,814 52	Interest paid	5,118 08
Premiums received	23,661 70	Dues repaid — installment stock	74,487 50
Fines received	150 39	Profits repaid — installment stock	18,188 70
Loans repaid	112,505 00	Paid-up and prepaid stock and dividends	43,573 73
Overdrafts and bills payable	32,274 50	Salaries	12,292 76
All other receipts	54,447 43	Taxes	6,872 08
		Other expenses	13,665 99
		All other disbursements	16,715 49
Total receipts	$448,379 82	Total disbursements	$448,379 82

INSTALLMENT STOCK, WITH VALUE AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Loan Fund Dues.	Book Value per Share.	Withdrawal Value.
100	$60 00	$50 00	$87 18	
96	57 60	48 00	79 72	
84	50 40	42 00	63 55	Loan Fund dues, and three fourths of profits.
72	43 20	36 00	51 00	
60	36 00	30 00	41 10	
48	28 80	24 00	31 82	
36	21 60	18 00	21 25	
24	14 40	12 00	13 31	
12	7 20	6 00	6 29	

No. 129—SAN JOSE.

MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated March 12, 1889.)

GEORGE N. JONES, Secretary. JAMES BEAN, President.

Fiscal year ends September 30, 1899.

No. of series, 18. No. of shares, 1,633½.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$54,888 18	Installment stock—dues	$50,282 60
Cash on hand and in bank	3,617 66	Earnings apportioned	8,283 40
Real estate owned	1,908 47	Reserve and undivided profits	532 61
Other assets	563 79	Other liabilities	1,879 49
Total assets	$60,978 10	Total liabilities	$60,978 10

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$7,123 88	Loans on mortgages and stock	$9,484 80
Installment stock—dues	22,491 49	Interest paid	33 42
Interest received	5,931 78	Dues repaid — installment stock	19,685 55
Fines received	80 20	Profits repaid — installment stock	7,960 98
Fees received	37 55	Salaries	748 00
Loans repaid	5,079 26	Taxes	1,591 67
All other receipts	2,794 10	Other expenses	259 03
		All other disbursements	157 15
		Balance on hand and in bank	3,617 66
Total receipts	$43,538 26	Total disbursements	$43,538 26

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
114	$114 00	$157 58	$157 58
96	96 00	121 83	121 83
84	84 00	101 29	101 29
72	72 00	81 70	81 70
60	60 00	66 96	66 96
48	48 00	51 98	51 98
36	36 00	38 11	38 11
24	24 00	25 05	25 05
12	12 00	12 34	12 34

No. 130—SAN JOSE.

NUCLEUS BUILDING AND LOAN ASSOCIATION.

(Incorporated April 1, 1889.)

F. C. ENSIGN, Secretary. GEO. B. MCKEE, President.

Fiscal year ends April 1, 1900.

No. of series, 16. No. of shares, 731.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$51,548 00	Installment stock—dues	$53,859 00
Arrearages		517 26	Earnings apportioned	18,308 69
On shares	$222 00		Advance payments	625 90
On interest	186 66		Reserve and undivided profits	96 37
On premiums	93 50		Unearned premiums	3,172 60
On fines, etc.	15 10			
Cash on hand and in bank		8,697 30		
Real estate owned		15,000 00		
Other assets		300 00		
Total assets		$76,062 56	Total liabilities	$76,062 56

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$10,557 29	Loans on mortgages and stock	$10,433 00
Installment stock—dues	9,277 00	Dues repaid — installment stock	20,285 00
Interest received	3,911 14	Profits repaid — installment stock	8,144 78
Premiums received	410 55	Salaries	968 35
Fines received	126 50	Taxes	905 83
Loans repaid	22,827 00	Other expenses	174 83
All other receipts	3,577 14	All other disbursements	1,077 53
		Balance on hand and in bank	8,697 30
Total receipts	$50,686 62	Total disbursements	$50,686 62

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	75	$132 00	$197 62	$197 34
2	5	126 00	182 61	178 92
3	79	119 00	169 17	160 30
4	36	111 00	152 22	146 93
5	76	107 00	145 07	135 62
6	34	101 00	133 15	126 50
7	48	95 00	123 06	117 56
8	55	88 00	110 77	104 13
9	10	80 00	98 33	93 33
10	22	68 00	80 19	77 63
11	28	57 00	64 88	62 41
12	53	47 00	52 24	50 68
13	31	35 00	37 58	37 04
14	19	22 00	22 98	22 81
15	55	12 00	12 26	12 00
16	105	4 00	4 08	4 00

No. 131—SAN JOSE.

SAN JOSE BUILDING AND LOAN ASSOCIATION.

(Incorporated January 30, 1885.)

A. K. WHITTON, Secretary. J. M. PITMAN, President.

Fiscal year ends December 31, 1899.

No. of series, 20. No. of shares, 1,665.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$216,904 74	Installment stock—dues	$112,040 13
Arrearages		5,125 00	Paid-up and prepaid stock	1,500 00
On shares	$2,456 00		Earnings apportioned	30,445 13
On interest	2,350 00		Advance payments	266 00
On fines, etc.	319 00		Overdrafts and bills payable	64,820 10
Cash on hand and in bank		1,170 18	Reserve and undivided profits	2,737 42
Real estate owned		7,593 85	Unearned premiums	16,421 91
Other assets		9,857 92	Other liabilities	12,421 00
Total assets		$240,651 69	Total liabilities	$240,651 69

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$8,655 39	Overdrafts and bills payable	$58,832 00
Installment stock—dues	21,562 00	Loans on mortgages and stock	21,561 22
Paid-up and prepaid stock	1,500 00	Interest paid	4,701 14
Interest received	14,135 59	Dues repaid — installment stock	66,300 00
Premiums received	323 40	Profits repaid — installment stock	10,985 93
Fines received	415 41	Salaries	1,975 00
Fees received	11 65	Taxes	2,976 82
Loans repaid	69,296 54	Other expenses	1,372 03
Overdrafts and bills payable	62,980 10	All other disbursements	29,290 01
All other receipts	20,284 25	Balance on hand and in bank	1,170 18
Total receipts	$199,164 33	Total disbursements	$199,164 33

INSTALLMENT STOCK, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF ONE SHARE, AT AGES INDICATED.

Age, in Months.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
119	$119 00	$170 77	Dues and 30 to 80% of profits.
107	107 00	146 71	
95	95 00	124 69	
83	83 00	104 37	
71	71 00	85 73	
59	59 00	68 45	
47	47 00	52 45	
35	35 00	41 28	
23	23 00	23 92	
11	11 00	11 05	

No. 132—SAN LUIS OBISPO.

SAN LUIS BUILDING AND LOAN ASSOCIATION.

(Incorporated March 1, 1888.)

M. LEWIN, Secretary. BENJAMIN BROOKS, President.

Fiscal year ends March 1, 1900.

No. of series, 8. No. of shares, 1,478.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$93,095 00	Installment stock—dues	$76,266 00
Arrearages		688 58	Earnings apportioned	21,566 12
On shares	$268 00		Advance payments	531 25
On interest	236 61		Reserve and undivided profits	480 33
On premiums	108 51		Other liabilities	1,959 47
On fines, etc.	75 46			
Cash on hand and in bank		6,356 72		
Real estate owned		650 00		
Other assets		12 87		
Total assets		$100,803 17	Total liabilities	$100,803 17

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,115 67	Loans on mortgages and stock	$14,300 00
Installment stock—dues	19,563 00	Dues repaid — installment stock	20,398 00
Interest received	6,606 79	Profits repaid — installment stock	8,430 46
Premiums received	2,553 49	Salaries	1,174 53
Fines received	134 91	Taxes	1,954 96
Fees received	66 30	Other expenses	146 41
Loans repaid	23,675 00	All other disbursements	1,430 93
All other receipts	476 85	Balance on hand and in bank	6,356 72
Total receipts	$54,192 01	Total disbursements	$54,192 01

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
3	140	$102 00	$150 39	$145 80
4	153	90 00	124 42	118 06
5	178	72 00	92 47	85 92
6	212	60 00	73 82	68 15
7	198	48 00	56 50	52 25
8	159	36 00	40 66	38 33
9	183	24 00	26 09	25 05
10	255	12 00	12 57	12 29

No. 133—SAN MATEO.

SAN MATEO MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated May 2, 1896.)

C. H. KIRKBRIDE, Secretary. E. A. HUSING, President.

Fiscal year ends December 31, 1899.

No. of series, 14. No. of shares, 604.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$21,875 00	Installment stock—dues	$16,431 00
Arrearages		158 56	Earnings apportioned	2,277 31
On shares	$57 00		Advance payments	408 60
On interest	70 31		Overdrafts and bills payable	1,900 00
On premiums	26 25		Reserve and undivided profits	260 46
On fines, etc.	5 00		Unearned premiums	132 65
Cash on hand and in bank		103 35	Other liabilities	726 89
Total assets		$22,136 91	Total liabilities	$22,136 91

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$270 93	Overdrafts and bills payable	$1,800 00
Installment stock—dues	7,423 00	Loans on mortgages and stock	9,384 84
Interest received	1,432 31	Interest paid	133 99
Premiums received	649 75	Dues repaid — installment stock	2,671 00
Fines received	41 20	Profits repaid — installment stock	179 64
Fees received	15 90	Salaries	225 00
Loans repaid	1,270 00	Taxes	263 19
Overdrafts and bills payable	3,700 00	Other expenses	42 08
All other receipts	420 46	All other disbursements	420 46
		Balance on hand and in bank	103 35
Total receipts	$15,223 55	Total disbursements	$15,223 55

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	144	$43 00	$50 62	$47 73
2	55	39 00	45 20	42 90
3	61	36 00	41 25	39 33
4	42	33 00	37 39	35 80
5	8	30 90	33 62	32 32
6	15	27 00	29 93	28 89
7	39	24 00	26 30	25 50
8	40	21 00	22 76	22 15
9	8	18 00	19 30	18 85
10	41	15 00	15 91	15 60
11	45	12 00	12 58	12 39
12	70	9 00	9 34	9 00
13	18	6 00	6 16	6 00
14	18	3 00	3 05	3 00

No. 134—SAN RAFAEL.

MARIN COUNTY MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated July 19, 1886.)

L. A. LANCEL, Secretary. H. P. WOOD, President.

Fiscal year ends July 31, 1899.

No. of series, 9. No. of shares, 2,242.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$120,800 00	Installment stock—dues	$88,488 00
Arrearages		36 30	Earnings apportioned	27,200 43
On shares	$28 00		Advance payments	446 00
On interest	3 50		Overdrafts and bills payable	2,660 31
On premiums	1 50		Reserve and undivided profits	276 06
On fines, etc.	3 30		Other liabilities	3,183 10
Real estate owned		1,417 60		
Total assets		$122,253 90	Total liabilities	$122,253 90

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$28,833 00	Overdrafts and bills payable	$3,544 08
Interest received	8,661 75	Loans on mortgages and stock	13,515 10
Premiums received	4,023 00	Interest paid	238 15
Fines received	106 70	Dues repaid — installment stock	30,867 00
Fees received	74 90	Profits repaid — installment stock	12,279 21
Loans repaid	20,100 00	Salaries	1,080 00
Overdrafts and bills payable	2,660 31	Taxes	1,692 19
		Other expenses	116 33
		All other disbursements	1,127 60
Total receipts	$64,459 66	Total disbursements	$64,459 66

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
5	55	$108 00	$183 95	$180 15
6	55	96 00	153 54	147 79
7	69	84 00	126 14	117 71
8	84	72 00	101 93	92 95
9	208	60 00	80 20	72 12
10	460	48 00	60 50	54 25
11	424	36 00	42 82	39 41
12	413	24 00	26 94	25 47
13	474	12 00	12 80	12 40

No. 135—SANTA ANA.

HOME MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated April 1, 1893.)

F. W. MANSUR, Secretary. JOHN MCFADDEN, President.

Fiscal year ends December 31, 1899.

No. of series, 6. No. of shares, 1,684.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$109,859 00	Installment stock—dues	$83,472 00
Arrearages		230 45	Earnings apportioned	22,193 03
On shares	$115 00		Overdrafts and bills payable	2,650 00
On interest	115 45		Reserve and undivided profits	662 85
Cash on hand and in bank		8 03	Unearned premiums	1,119 60
Total assets		$110,097 48	Total liabilities	$110,097 48

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$745 92	Loans on mortgages and stock	$29,605 00
Installment stock—dues	20,610 00	Interest paid	39 25
Interest received	7,614 35	Dues repaid — installment stock	8,993 00
Premiums received	779 94	Profits repaid — installment stock	2,130 01
Fines received	15 60	Salaries	570 65
Fees received	29 25	Taxes	1,536 02
Loans repaid	9,790 00	Other expenses	100 35
Overdrafts and bills payable	2,650 00	All other disbursements	283 20
All other receipts	1,030 45	Balance on hand and in bank	8 03
Total receipts	$43,265 51	Total disbursements	$43,265 51

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	426	$80 00	$107 27	$100 45
2	423½	60 00	75 61	69 36
3	133½	48 00	58 30	53 15
4	275½	36 00	42 16	39 08
5	212½	24 00	27 12	25 56
6	213	12 00	13 08	12 60

No. 136—SANTA BARBARA.

LOAN AND BUILDING ASSOCIATION.

(Incorporated May 23, 1887.)

J. T. JOHNSON, Secretary. H. L. STAMBACH, President.

Fiscal year ends July 6, 1899.

No. of series, 9. No. of shares, 2,715.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$137,314 00	Installment stock—dues	$111,894 00
Arrearages		2,080 90	Paid-up and prepaid stock	9,700 00
On shares	$798 00		Earnings apportioned	23,911 45
On interest	1,097 40		Advance payments	285 50
On premiums	62 50		Reserve and undivided profits	285 20
On fines, etc.	123 00		Other liabilities	520 00
Cash on hand and in bank		7,121 25		
Other assets		80 00		
Total assets		$146,596 15	Total liabilities	$146,596 15

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,706 64	Loans on mortgages and stock	$29,010 00
Installment stock—dues	33,423 00	Interest paid	514 50
Paid-up and prepaid stock	3,400 00	Dues repaid — installment stock	25,520 00
Interest received	11,958 55	Profits repaid — installment stock	7,190 10
Premiums received	814 10	Paid-up and prepaid stock	2,250 00
Fines received	176 40	Salaries	800 00
Fees received	96 35	Taxes	2,994 19
Loans repaid	21,760 00	Other expenses	190 15
All other receipts	3,087 50	All other disbursements	1,832 35
		Balance on hand and in bank	7,121 25
Total receipts	$77,422 54	Total disbursements	$77,422 54

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
3	55	$102 00	$145 70	$141 35
4	222	90 00	121 60	118 45
5	215	78 00	100 10	97 90
6	184	66 00	81 20	78 20
7	239	54 00	63 75	61 80
8	438	42 00	47 55	45 90
9	559	30 00	32 85	32 10
10	375	18 00	19 05	18 65
11	428	6 00	6 25	6 15

No. 137—SANTA CLARA.

SANTA CLARA BUILDING AND LOAN ASSOCIATION.

(Incorporated March 19, 1889.)

F. O. RALL, Secretary. J. B. O'BRIEN, President.

Fiscal year ends March 31, 1900.

No. of series, 11. No. of shares, 880.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$68,000 00	Installment stock—dues	$47,758 50
Arrearages	1,086 60	Earnings apportioned	15,023 90
On shares $603 50		Advance payments	347 00
On interest 385 05		Reserve and undivided profits	1,404 06
On fines, etc. 98 05		Unearned premiums	8,721 93
Cash on hand and in bank	3,899 66	Other liabilities	436 17
Real estate owned	400 00		
Other assets	305 30		
Total assets	$73,691 56	Total liabilities	$73,691 56

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$107 97	Loans on mortgages and stock	$1,400 00
Installment stock—dues	13,515 00	Interest paid	3 13
Interest received	6,265 85	Dues repaid — installment stock	43,527 00
Premiums received	340 00	Profits repaid — installment stock	20,974 15
Fines received	96 25	Salaries	420 00
Loans repaid	49,200 00	Taxes	1,328 89
All other receipts	3,524 55	Other expenses	126 93
		All other disbursements	1,369 86
		Balance on hand and in bank	3,899 66
Total receipts	$73,049 62	Total disbursements	$73,049 62

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	2½	$129 00	$200 00	$200 00
2	50	120 00	180 00	180 00
3	61	108 00	156 60	155 00
4	72	96 00	134 40	129 00
5	63	84 00	113 40	108 00
6	47	72 00	93 60	88 00
7	81	60 00	75 00	70 00
8	94	48 00	57 60	52 50
9	117	36 00	41 40	38 00
10	180½	24 00	26 40	24 50
11	112	12 00	12 60	12 25

No. 138—SANTA PAULA.

SANTA PAULA BUILDING AND LOAN ASSOCIATION.

(Incorporated April 21, 1890.)

H. H. YOUNGKEN, Secretary. J. R. HOUGH, President.

Fiscal year ends May 12, 1900.

No. of series, 10. No. of shares, 1,370.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$56,400 00	Installment stock—dues	$48,582 00
Arrearages		705 40	Earnings apportioned	10,653 95
On shares	$376 00		Advance payments	11 67
On interest	256 39		Unearned premiums	2,460 00
On fines, etc.	73 01			
Cash on hand and in bank		3,802 04		
Real estate owned		608 30		
Other assets		191 88		
Total assets		$61,707 62	Total liabilities	$61,707 62

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$632 64	Loans on mortgages and stock	$8,900 00
Installment stock—dues	16,863 52	Dues repaid — installment stock	16,740 08
Interest received	4,041 26	Profits repaid — installment stock	5,960 81
Premiums received	356 10	Salaries	600 00
Fines received	31 24	Taxes	444 94
Fees received	48 10	Other expenses	126 57
Loans repaid	14,700 00	All other disbursements	129 35
All other receipts	30 93	Balance on hand and in bank	3,802 04
Total receipts	$36,703 79	Total disbursements	$36,703 79

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
5	146	$72 00	$98 64	$98 64
6	111	60 00	77 50	77 50
7	172	48 00	58 68	54 94
7½	54	42 00	49 97	46 41
8	279	36 00	41 73	39 36
8½	44	30 00	33 90	32 33
9	238	24 00	26 45	25 50
9½	31	18 00	19 37	18 85
10	247	12 00	12 61	12 39
10½	48	6 00	6 17	6 10

No. 139—SANTA ROSA.

SANTA ROSA BUILDING AND LOAN ASSOCIATION.

(Incorporated October 3, 1888.)

C. D. Barnett, Secretary. Allen B. Lemmon, President.

Fiscal year ends October 31, 1899.

No. of series, 10. No. of shares, 1,619½.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$96,466 80	Installment stock—dues	$64,188 00
Arrearages		1,147 49	Earnings apportioned	12,215 97
On shares	$482 50		Advance payments	70 00
On interest	500 65		Overdrafts and bills payable	18,977 65
On premiums	59 00		Reserve and undivided profits	15 25
On fines, etc.	105 34		Other liabilities	3,546 02
Real estate owned		1,358 00		
Other assets		40 60		
Total assets		$99,012 89	Total liabilities	$99,012 89

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$9,671 39	Overdrafts and bills payable	$10,000 00
Installment stock—dues	22,556 50	Loans on mortgages and stock	16,576 80
Interest received	7,708 15	Interest paid	127 77
Premiums received	1,246 70	Dues repaid — installment stock	58,942 50
Fines received	212 53	Profits repaid — installment stock	30,965 95
Fees received	50 60	Salaries	480 00
Loans repaid	48,200 00	Taxes	687 91
Overdrafts and bills payable	28,977 65	Other expenses	278 70
All other receipts	361 11	All other disbursements	925 00
Total receipts	$118,984 63	Total disbursements	$118,984 63

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
2	32	$120 00	$180 97	$168 00
3	9	108 00	155 28	146 88
4	53	96 00	130 55	126 72
5	60	84 00	107 97	107 52
6	147	72 00	88 57	88 20
7	153½	60 00	70 64	70 50
8	213	48 00	54 11	54 04
9	198	36 00	39 30	39 24
10	254½	24 00	25 42	25 32
11	499½	12 00	12 37	12 30

No. 140—SAUSALITO.

SAUSALITO MUTUAL LOAN ASSOCIATION.

(Incorporated December 20, 1887.)

THOMAS PENLINGTON, Secretary. O. C. MILLER, President.

Fiscal year ends October 31, 1899.

No. of series, 6. No. of shares, 755.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$28,325 00	Installment stock—dues	$27,780 00
Arrearages		637 43	Earnings apportioned	6,025 84
On shares	$323 00		Reserve and undivided profits	25 20
On interest	220 08			
On premiums	82 75			
On fines, etc.	11 60			
Cash on hand and in bank		657 23		
Real estate owned		4,182 73		
Other assets		28 65		
Total assets		$33,831 04	Total liabilities	$33,831 04

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,403 88	Overdrafts and bills payable	$3,050 00
Installment stock—dues	10,262 50	Loans on mortgages and stock	7,800 00
Interest received	2,345 35	Interest paid	36 25
Premiums received	883 44	Dues repaid — installment stock	11,486 50
Fines received	55 69	Profits repaid — installment stock	2,626 77
Fees received	20 60	Salaries	360 00
Loans repaid	8,200 00	Taxes	253 93
Overdrafts and bills payable	3,050 00	Other expenses	56 03
All other receipts	128 50	All other disbursements	23 25
		Balance on hand and in bank	657 23
Total receipts	$26,349 96	Total disbursements	$26,349 96

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
7	60	$72 00	$96 39	$93 96
8	132	60 00	76 20	72 96
9	127	48 00	58 16	55 12
10	131	36 00	41 65	39 39
11	89	24 00	26 48	25 24
12	161	12 00	12 65	12 00
12 B	55	12 00	13 24	12 62

No. 141—SAUSALITO. (Office in San Francisco.)

TAMALPAIS MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated March 20, 1897.)

JULIAN B. HARRIES, Secretary. T. W. JACKSON, President.

Fiscal year ends April 30, 1900.

No. of series, 4. No. of shares, 66.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$2,100 00	Installment stock—dues	$1,890 00
Arrearages		156 67	Paid-up and prepaid stock	300 00
On shares	$115 00		Earnings apportioned	110 26
On interest	29 17		Reserve and undivided profits	97
On premiums	12 50			
Cash on hand and in bank		44 56		
Total assets		$2,301 23	Total liabilities	$2,301 23

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$260 33	Loans on mortgages and stock	$800 00
Installment stock—dues	805 00	Interest paid	1 20
Paid-up and prepaid stock	300 00	Dues repaid — installment stock	540 00
Interest received	117 34	Paid-up and prepaid stock	100 00
Premiums received	46 50	Salaries	20 00
Fines received	15 00	Taxes	21 36
Fees received	80	Other expenses	17 85
		Balance on hand and in bank	44 56
Total receipts	$1,544 97	Total disbursements	$1,544 97

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	70	40	$36 00	$38 16	$38 16
2	13	13	24 00	25 38	25 38
3	5	5	18 00	19 04	19 04
4	----------	8	6 00	6 09	6 09

No. 142—STOCKTON.

SAN JOAQUIN VALLEY BUILDING AND LOAN ASSOCIATION.

(Incorporated June 17, 1889.)

A. M. NOBLE, Secretary. S. N. CROSS, President.

Fiscal year ends December 31, 1899.

No. of series, 7. No. of shares, 1,875.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$128,379 81	Installment stock—dues	$108,319 90
Arrearages		1,406 97	Paid-up and prepaid stock	6,400 00
On interest	$1,279 07		Earnings apportioned	48,292 11
On fines, etc.	127 90		Reserve and undivided profits	4,335 06
Cash on hand and in bank		5,286 68	Unearned premiums	2,539 75
Real estate owned		34,653 01		
Other assets		160 35		
Total assets		$169,886 82	Total liabilities	$169,886 82

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,323 78	Loans on mortgages and stock	$24,429 77
Installment stock—dues	9,663 40	Interest paid	50
Paid-up and prepaid stock	6,400 00	Dues repaid — installment stock	16,951 00
Interest received	4,152 45	Profits repaid — installment stock	7,526 23
Fines received	126 20	Salaries	593 00
Fees received	12 75	Taxes	634 27
Loans repaid	35,250 79	Other expenses	418 63
All other receipts	1,132 65	All other disbursements	3,221 94
		Balance on hand and in bank	5,286 68
Total receipts	$59,062 02	Total disbursements	$59,062 02

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	465½	$125 00	$198 49	$198 49
2	152½	112 00	167 12	167 12
3	164	80 00	103 13	103 13
4	92	52 00	59 77	59 77
5	230½	38 00	41 80	41 80
6	237	20 00	20 88	20 88
7	469½	5 00	5 08	5 00

NOTE.—This report covers only five months owing to a change in ending of fiscal year.

No. 143—STOCKTON.

STOCKTON LAND, LOAN, AND BUILDING ASSOCIATION.

(Incorporated January 3, 1887.)

R. E. Wilhoit, Secretary. J. D. Young, President.

Fiscal year ends January 31, 1900.

No. of series, none. No. of shares, 3,724½.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$458,609 54	Installment stock—dues	$320,193 01
Arrearages		7,940 05	Earnings apportioned	145,081 09
On interest	$7,760 80		Advance payments	311 50
On fines, etc.	179 25		Reserve and undivided profits	4,799 15
Cash on hand and in bank		1,946 85	Unearned premiums	12,073 17
Real estate owned		12,579 99	Other liabilities	1 75
Other assets		1,383 24		
Total assets		$482,459 67	Total liabilities	$482,459 67

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$19,122 85	Loans on mortgages and stock	$105,402 84
Installment stock—dues	43,578 50	Interest paid	31 73
Interest received	36,628 06	Dues repaid — installment stock	111,508 49
Premiums received	30 40	Profits repaid — installment stock	56,319 40
Fines received	336 35	Salaries	2,001 00
Fees received	48 90	Taxes	6,676 75
Loans repaid	185,931 91	Other expenses	553 70
All other receipts	4,545 29	All other disbursements	5,781 50
		Balance on hand and in bank	1,946 85
Total receipts	$290,222 26	Total disbursements	$290,222 26

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Last Report.	Shares Now in Force.	Total Dues per Series.	Book Value per Series.	Withdrawal Value.
None	4,213½	3,724½	$320,193 01	$465,274 10	*

* Book value, including dues and profits, less 2%.
Dayton plan.

No. 144—TULARE.

TULARE BUILDING AND LOAN ASSOCIATION.

(Incorporated January, 1889.)

H. M. SHREVE, Secretary. WM. MOLLER, President.

Fiscal year ends December 31, 1899.

No. of series, 9. No. of shares, 582½.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$64,919 15	Installment stock—dues	$48,255 00
Arrearages		2,410 92	Earnings apportioned	23,376 45
On shares	$1,466 17		Advance payments	1,641 78
On interest	649 43		Overdrafts and bills payable	10,454 92
On premiums	109 18		Reserve and undivided profits	862 54
On fines, etc.	186 14		Unearned premiums	3,452 05
Real estate owned		20,481 35	Other liabilities	75 68
Other assets		307 00		
Total assets		$88,118 42	Total liabilities	$88,118 42

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$7,251 92	Overdrafts and bills payable	$1,895 89
Interest received	5,593 34	Interest paid	1,940 83
Fines received	330 78	Dues repaid — installment stock	8,739 72
Fees received	90	Profits repaid — installment stock	4,122 76
Loans repaid	5,000 00	Salaries	776 43
Overdrafts and bills payable	454 92	Taxes	1,211 71
All other receipts	2,520 94	Other expenses	302 12
		All other disbursements	2,163 34
Total receipts	$21,152 80	Total disbursements	$21,152 80

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	75	$112 00	$200 00	$200 00
2	55	114 00	199 00	177 75
3	107	102 00	155 11	141 81
4	113	90 00	127 91	118 41
5	90½	78 00	97 05	92 28
6	34	66 00	79 04	79 04
7	35	54 00	61 87	57 93
8	37	30 00	31 74	30 87
9	36	18 00	18 44	18 22

No. 145—UKIAH.

UKIAH MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated May 1, 1894.)

J. M. MANNON, Secretary. W. D. WHITE, President.

Fiscal year ends May 5, 1900.

No. of series, 6. No. of shares, 496¾.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$27,350 00	Installment stock—dues	$26,682 00
Arrearages		627 40	Earnings apportioned	8,443 92
On shares	$184 00		Advance payments	16 65
On interest	245 30		Reserve and undivided profits	138 14
On premiums	180 00		Unearned premiums	385 76
On fines, etc.	18 10			
Cash on hand and in bank		7,616 20		
Other assets		72 87		
Total assets		$35,666 47	Total liabilities	$35,666 47

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$5,978 53	Loans on mortgages and stock	$1,450 00
Installment stock—dues	6,733 00	Dues repaid — installment stock	10,280 50
Interest received	2,287 30	Profits repaid — installment stock	2,831 67
Premiums received	1,463 00	Salaries	300 00
Fines received	11 60	Taxes	671 29
Fees received	3 75	Other expenses	54 65
Loans repaid	4,250 00	All other disbursements	22 87
All other receipts	2,500 00	Balance on hand and in bank	7,616 20
Total receipts	$23,227 18	Total disbursements	$23,227 18

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	169½	$72 00	$100 02	$87 12
2	151	60 00	78 76	70 50
3	34	48 00	59 40	54 72
4	38¼	36 00	42 01	39 24
5	96¾	24 00	26 48	25 44
6	7¼	12 00	12 60	12 36

No. 146—VENTURA.

VENTURA MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated February 1, 1897.)

CHARLES BARNARD, Secretary. F. W. BAKER, President.

Fiscal year ends March 5, 1900.

No. of series, 3. No. of shares, 529.

FINANCIAL STATEMENT.

Assets.		*Liabilities.*	
Loans on mortgages and stock	$17,753 00	Installment stock—dues	$16,842 00
Cash on hand and in bank	1,778 39	Earnings apportioned	2,309 86
Other assets	23 00	Advance payments	20 50
		Reserve and undivided profits	382 03
Total assets	$19,554 39	Total liabilities	$19,554 39

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,216 98	Loans on mortgages and stock	$10,510 00
Installment stock—dues	6,535 00	Dues repaid — installment stock	856 50
Interest received	1,318 40	Profits repaid — installment stock	68 25
Premiums received	420 50	Salaries	120 00
Fees received	26 27	Taxes	181 36
Loans repaid	3,917 00	Other expenses	17 20
All other receipts	97 55	Balance on hand and in bank	1,778 39
Total receipts	$13,531 70	Total disbursements	$13,531 70

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	384½	$36 00	$41 35	$39 15
2	105½	24 00	26 18	25 38
3	39	12 00	12 52	12 33

No. 147—VISALIA.

VISALIA BUILDING AND LOAN ASSOCIATION.

(Incorporated January 5, 1887.)

C. L. JOHNSON, Secretary. C. J. GIDDINGS, President.

Fiscal year ends February 10, 1900.

No. of series, 4. No. of shares, 1,324.

FINANCIAL STATEMENT.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$52,600 00	Installment stock—dues	$39,309 00
Arrearages		269 98	Earnings apportioned	10,058 83
On shares	$200 89		Overdrafts and bills payable	8 15
On interest	62 42		Reserve and undivided profits	576 60
On fines, etc.	6 67		Unearned premiums	8,249 61
Real estate owned		4,966 51		
Other assets		365 70		
Total assets		$58,202 19	Total liabilities	$58,202 19

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Installment stock—dues	$12,232 40	Overdrafts and bills payable	$6,829 71
Interest received	4,163 34	Loans on mortgages and stock	9,800 00
Premiums received	2,313 97	Interest paid	151 53
Fines received	119 28	Dues repaid — installment stock	7,089 00
Fees received	22 50	Profits repaid — installment stock	2,009 99
Loans repaid	9,400 00	Salaries	480 00
Overdrafts and bills payable	8 15	Taxes	910 58
All other receipts	506 25	Other expenses	83 99
		All other disbursements	1,411 09
Total receipts	$28,765 89	Total disbursements	$28,765 89

INSTALLMENT STOCK IN FORCE, WITH AGE, VALUE, AND WITHDRAWAL VALUE OF SHARES.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
4	87	$60 00	$82 83	$82 83
5	492	48 00	61 29	61 29
6	667	15 00	17 26	17 26
7	78	6 00	6 34	6 34

No. 148—WATSONVILLE.

WATSONVILLE MUTUAL BUILDING AND LOAN ASSOCIATION.

(Incorporated April 12, 1897.)

C. A. Palmtag, Secretary. James Waters, President.

Fiscal year ends April 30, 1900.

No. of series, 19. No. of shares, 1,707.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$20,225 00	Installment stock—dues	$23,394 00
Arrearages		343 20	Earnings apportioned	2,757 59
On shares	$227 60		Advance payments	518 50
On interest	48 00		Reserve and undivided profits	212 48
On premiums	57 60			
Cash on hand and in bank		6,291 37		
Other assets		23 00		
Total assets		$26,882 57	Total liabilities	$26,882 57

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$2,787 51	Loans on mortgages and stock	$10,450 00
Installment stock—dues	10,181 40	Interest paid	17 21
Interest received	1,040 90	Dues repaid — installment stock	1,581 00
Premiums received	1,261 50	Profits repaid — installment stock	10 53
Fines received	25 82	Salaries	309 15
Fees received	58 60	Taxes	306 47
Loans repaid	3,900 00	Other expenses	290 00
		Balance on hand and in bank	6,291 37
Total receipts	$19,255 73	Total disbursements	$19,255 73

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	660	$21 60	$24 66	
2	65	21 00	23 87	
3	5	19 80	22 29	
4	31	19 20	21 51	
5	15	18 60	20 74	
6	5	17 40	19 23	
7	35	16 20	17 76	
8	85	15 60	17 01	
9	5	15 00	16 31	Dues and 4% after one year.
10	5	13 80	15 60	
11	10	13 20	14 20	
11½	20	12 60	13 53	
12	160	11 40	12 14	
13	25	10 80	11 33	
14	70	9 00	9 46	
15	10	6 60	6 86	
16	166	4 80	4 98	
17	280	2 40	2 44	
18	55	60	60	

No. 149—WOODLAND.

WOODLAND BUILDING AND LOAN ASSOCIATION.

(Incorporated June 8, 1886.)

E. T. Clowe, Secretary. J. I. McConnell, President.

Fiscal year ends December 31, 1899.

No. of series, 1. No. of shares, 434.

Financial Statement.

Assets.			*Liabilities.*	
Loans on mortgages and stock		$29,231 22	Installment stock—dues	$36,456 00
Arrearages		4,289 51	Earnings apportioned	6,385 04
On shares	$1,524 00		Reserve and undivided profits	9 72
On interest	2,673 46		Other liabilities	427 36
On premiums	92 05			
Cash on hand and in bank		1,364 95		
Real estate owned		8,127 61		
Other assets		264 83		
Total assets		$43,278 12	Total liabilities	$43,278 12

Receipts for Fiscal Year.		*Disbursements for Fiscal Year.*	
Balance last report	$1,571 36	Loans on mortgages and stock	$2,623 20
Installment stock—dues	4,802 00	Interest paid	15 05
Interest received	1,801 47	Dues repaid — installment stock	10,403 00
Fines received	20 00	Salaries	600 00
Loans repaid	4,131 25	Taxes	249 10
All other receipts	4,347 18	Other expenses	134 74
		All other disbursements	1,283 22
		Balance on hand and in bank	1,364 95
Total receipts	$16,673 26	Total disbursements	$16,673 26

Installment Stock in Force, with Age, Value, and Withdrawal Value of Shares.

Serial No.	Shares Now in Force.	Total Dues per Share.	Book Value per Share.	Withdrawal Value.
1	434	$84 00	$98 71	$84 00

UNIVERSITY OF CALIFORNIA—COLLEGE OF AGRICULTURE.

AGRICULTURAL EXPERIMENT STATION.

REPORT OF WORK

OF THE

AGRICULTURAL EXPERIMENT STATION

OF THE

UNIVERSITY OF CALIFORNIA,

FOR THE YEAR 1897-8.

BEING A PART OF THE REPORT OF THE REGENTS OF THE UNIVERSITY.

SACRAMENTO:
A. J. JOHNSTON, : : : : SUPERINTENDENT STATE PRINTING.
1900.

REPORT

OF THE

PROFESSOR OF AGRICULTURE AND DIRECTOR OF THE EXPERIMENT STATION

TO THE

PRESIDENT OF THE UNIVERSITY.

SPECIAL NOTICE TO PERSONS SENDING SAMPLES FOR EXAMINATION TO THE EXPERIMENT STATION.

1. The work of the Station being designed for the benefit of the agricultural public, we do not undertake to investigate matters of purely private interest, unless conclusions subserving the public interest can be drawn therefrom. Nor does the Station undertake to solve riddles for the merely curious. It should, however, be understood that the examination of soils, waters, insects, plants, and other natural or new materials of interest to the agriculturist forms part of the general plan of investigation of the resources of the State. So far, therefore, as any such examination fills a gap in our knowledge of the State, it will fall within our province, even though for the moment benefiting only an individual. Special directions for the proper taking of soil and water samples will be sent on application.

2. In order to insure attention and examination, *every sample sent must be accompanied by a full statement of the origin, mode of occurrence, or special nature of the object sent*, with a mention of the particular points upon which information is desired, and the object in view in asking the question. Without such information the Station would, in many cases, have to go to an amount of trouble quite disproportionate to the value or importance of the object to be obtained, nor would the public interest be subserved.

3. **Each package sent, whether singly or inclosed with others in box or bag, must be distinctly labeled and marked with the sender's name and address.** The Station staff cannot undertake to re-label such packages, and thus avoid the mistakes and losses liable to happen as the result of this omission. Whether sent by mail or express, all packages must be *prepaid by the sender*, unless sent by special request of the Station.

4. Reports of such examinations will be sent by letter, when completed, and the results will be published in the ensuing annual report of the Station.

Remember that your package is but one of many that may arrive on the same day, and that our staff cannot afford to spend their time in comparing and identifying the handwriting on letters and packages; also, that for the same reason immediate action upon the sample cannot be expected, but that you must take your turn among the rest. If, for particular reasons, an immediate answer is desired, state the fact and the reasons therefor, and, so far as possible, examination will be expedited.

The Station publications (REPORT and BULLETINS) *will be sent to any citizen of the State on application, so long as available.*

TABLE OF CONTENTS.

CULTURE WORK AT THE CENTRAL STATION AND THE SUBSTATIONS—Continued.

ILLUSTRATIONS.

EXPERIMENT STATION OF THE UNIVERSITY OF CALIFORNIA.

CENTRAL STATION (Berkeley, Alameda County).

E. W. Hilgard, Ph.D., LL.D., *Director and Chemist.*
E. J. Wickson, M.A., *Horticulturist and Superintendent of Agricultural Grounds.*
R. H. Loughridge, Ph.D., *Agricultural Geologist and Chemist.*
C. W. Woodworth, M.S., *Entomologist.*
W. A. Setchell, Ph.D., *Botanist.*
M. E. Jaffa, M.S., *First Assistant Chemist, Agricultural Laboratory.*
Arthur P. Hayne,* Ph.B., *Assistant in Charge of Viticulture and Olive-culture.*
George E. Colby, M.S., *Second Assistant Chemist, Agricultural Laboratory.*
Frederick T. Bioletti, B.S., *Bacteriologist and Foreman of Viticultural Cellar.*
J. Burtt Davy, *Assistant Botanist.*
Charles H. Shinn, A.B., *Inspector of Stations.*
Emil Kellner, *Foreman of Central Station Grounds.*
A. V. Stubenrauch,* B.S., *Clerk to the Director.*

SIERRA FOOTHILL CULTURE SUBSTATION (near Jackson, Amador County).
R. C. Rust, *Patron;* Jackson.
J. W. Neal, *Workman in Charge.*

SOUTHERN COAST RANGE CULTURE SUBSTATION (near Paso de Robles, San Luis Obispo County).
F. D. Frost, *Patron;* Paso Robles.
John H. Barber, *Foreman;* Paso Robles.

SAN JOAQUIN VALLEY CULTURE SUBSTATION (near Tulare City, Tulare County).
John Tuohy, *Patron;* Tulare City.
Julius Forrer, *Foreman;* Tulare City.

SOUTHERN CALIFORNIA CULTURE SUBSTATION (between Pomona and Chino).
C. F. Loop,** *Patron;* Pomona.
J. W. Mills, *Foreman;* Ontario.

CHICO FORESTRY SUBSTATION (near Chico, Butte County).
V. C. Richards, *Patron;* Chico.
H. B. Allen,* *Workman in Charge;* Chico.

SANTA MONICA FORESTRY SUBSTATION (near Santa Monica, Los Angeles County).
Roy Jones, *Patron;* Santa Monica.
C. A. Colmore,* *Foreman;* Santa Monica.

VITICULTURAL SUBSTATION (under private auspices; relinquished, 1899).
East Side Santa Clara Valley Substation; Mission San José, Alameda County.
John Gallegos, *Patron;* Mission San José.

Additions and Changes to 1900.

Leroy Anderson, M.S.A., *Dairy Husbandman.*
A. M. dal Piaz, *Assistant in Viticulture.*
Carroll Fowler, B.S., *Assistant in Entomology.*
Frank J. Snow, *Student Assistant in Agr. Chem. Laboratory.*
C. A. Colmore, *Clerk to Director.*
S. N. Androus, *Patron Southern California Station.*
Wm. Shutt, *Foreman Santa Monica Forestry Station.*

* Resigned. ** Deceased.

COURSES IN AGRICULTURE AT THE UNIVERSITY OF CALIFORNIA.*

Agricultural Chemistry and Soil Physics—

1. *General Course.* (*a*) Chemistry and Physics of Plants; (*b*) Soils and Theory of Culture. Professor HILGARD and Assistant Professor LOUGHRIDGE.

1*c*. *Soil and Climate:* Lectures. Professor HILGARD.

1*d*. *Soil Physics:* Lectures. Assistant Professor LOUGHRIDGE.

17. *Soil Areas and Soil Distribution in California:* Lectures. Assistant Professor LOUGHRIDGE.

3. *Agricultural Laboratory.* Assistant Professor JAFFA and Mr. COLBY.

Animal Industry and Dietetics—

4*a*. *General Course.* Professor WICKSON.

4*c*. *Chemistry of Dairy Products.* Assistant Professor JAFFA.

3*a*. *Foods and Feeding;* (*b*) Principles of Nutrition; (*c*) Composition of Human Foods; (*d*) Laboratory Course. Assistant Professor JAFFA.

8. *Apiculture.* Assistant Professor WOODWORTH.

Agriculture, Horticulture, and Viticulture—

4(*b*). *General Course.* Professor WICKSON.

5(*b*). *Olive Culture;* (*d*) *Viticulture.* Assistant Professor HAYNE and Mr. BIOLETTI.

2. *Vinification.* Mr. BIOLETTI and Mr. DAL PIAZ.

2*a*. *Analyses of Musts and Wines;* (*b*) Adulterations of Liquors. Mr. COLBY.

6. *Beet Sugar Industry.* Professor HILGARD.

21. *Advanced Work in Horticulture.* Professor WICKSON.

Entomology, Plant Diseases, and Bacteriology—

7(*a*). *Entomological Œcology;* (*b*) Laboratory; (*c*) Elementary Entomology; (*d*) Economic Entomology. Assistant Professor WOODWORTH.

11. *Systematic and Structural Entomology.* Assistant Professor WOODWORTH.

12. *Entomological Laboratory.* 24. Research Work. Assistant Professor WOODWORTH.

9. *Parasitic Plant Diseases.* Assistant Professor WOODWORTH and Mr. BIOLETTI.

9*a*. *Bacteria;* (*b*) Laboratory; (*c*) Zymology. Mr. BIOLETTI.

Botany—

8. *Economic Botany.* (*a*) Weeds and Seed Testing; (*b*) Forage Plants. Mr. DAVY.

Agricultural Seminary—

13. *Elementary course for study of current agricultural literature.* Professor WICKSON and other instructors.

14. *University Extension in Agriculture.* Professor WICKSON.

*In addition to the general requirements in mathematics, literature, languages, and general sciences; for detailed description of which see the General University Register.

FINANCIAL STATEMENT, 1897-98.

The Agricultural Experiment Station of the University of California, in Account with the United States Appropriation, 1897-98.

		Cr. 1897-98.	Dr. 1897-98.
1898.			
	To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1898, as per Act of Congress approved March 2, 1887		$15,000 00
June 30—By	Salaries	$6,660 00	
	Labor	4,500 00	
	Publication	300 00	
	Postage and stationery	150 00	
	Freight and express	200 00	
	Heat, light, and water	150 00	
	Chemical supplies	250 00	
	Seeds, plants, and sundry supplies	400 00	
	Fertilizers	100 00	
	Feeding-stuffs	600 00	
	Library	100 00	
	Tools, implements, and machinery	150 00	
	Furniture and fixtures	250 00	
	Scientific apparatus	200 00	
	Live-stock	50 00	
	Traveling expenses	400 00	
	Contingent expenses	40 00	
	Building and repairs	500 00	
	Totals	$15,000 00	$15,000 00

We, the undersigned, duly appointed Finance Committee of the Corporation, do hereby certify that we have examined the books and accounts of the Agricultural Experiment Station of the University of California, for the fiscal year ending June 30, 1898, and that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000, and the corresponding disbursements $15,000; for all of which proper vouchers are on file and have been by us examined and found correct.

And we further certify that the expenditures have been solely for the purposes set forth in the Act of Congress approved March 2, 1887.

A. S. HALLIDIE,
ALBERT MILLER,
I. W. HELLMAN, SR.,
Finance Committee.

I hereby certify that the foregoing statement is correct, as shown in the books of the Agricultural Experiment Station of the University.

JOHN J. HERR,
Auditor.

LETTER OF TRANSMITTAL.

President Benjamin Ide Wheeler:

Dear Sir: I transmit herewith the manuscript of a report on the work of the California Experiment Station for the season 1897–8.

As is implied in the date given, this report is delayed considerably beyond the usual time of issuance; and the causes of this delay require some explanation.

As is well known, the staff of the College of Agriculture has from the outset been charged with the double duties of instruction and experimentation. Under the conditions prevailing in this State, I have considered this an unmixed advantage, so long as the staff was sufficiently numerous to carry both kinds of work; not only from the general principle that investigation serves to vivify instruction for the teacher as well as for the student, but particularly because in this State, as in the arid region generally, the conditions are so different from those of the humid region east of the Mississippi, as well as of Europe, that to render instruction practical and fruitful it becomes necessary to investigate the facts as they exist here, and to apply to them such principles as are *really* of general application, while essentially modifying both such principles and practice as are here inapplicable. The conditions of agriculture in the arid region have been so little studied until now, that the most competent experts from the humid region find themselves at fault, and must undergo a prolonged apprenticeship before they can usefully practice or teach here.

For a number of years past, I have been obliged to urge upon the President of the University and the Board of Regents the fact that the staff had become unable to bear the burden of this double work, on account of the increasing interest of the people of the State in the research work of the Station, which created a demand for information based upon special research that, even without instructional duties, would easily occupy the full time of the personnel, if the original objects of the Hatch Experiment Station Act, viz: "the investigation of the principles and science of agriculture," were duly kept in view.

It has been thought by some that a portion of the work which the Station has undertaken to do for individuals, was really outside of its legitimate functions; and this would be true to some extent but for the fact already referred to, namely, the newness of the peculiarities of the arid region to science, and the lack of an agricultural survey of the State. In order to render instruction at all useful commensurately with what it is elsewhere, such a survey should have preceded it. As it has been impossible to obtain from the State any funds available for this purpose, it became necessary to acquire the needful knowledge otherwise; and it must be said that whatever we now do know regarding the agricultural features of the State, has been obtained most largely

through work provided for by the General Government (especially the Tenth Census), partly through travel rendered possible by the funds provided by individuals who desired examinations made; also to some extent by correspondence, and the sending of specimens. Since the establishment of the outlying substations, following the passage of the Hatch Act, the regions where these are located have of course come under the more accurate observation of the foremen, as well as of the Inspector and Director in their periodic visits; and the increased interest of the surrounding population manifests itself by constantly increasing demands for the solution of special problems.

The data thus collected have enabled the Station to outline in colors upon a large map of the State, the various soil areas of the several agricultural regions, and many of the minor features of the interior valleys and mountain ranges. A revised copy of this map, originally prepared for the Columbian Exposition at Chicago, has been sent to the Paris Exposition as portion of the Station exhibit.

If the cumulative duties of instruction and station work already exceeded the possibilities of satisfactory performance by the staff, despite the practical abolition of the vacations which are enjoyed by all other teachers of the University, the situation became impracticable when to these duties was superadded that of attending from eighty to one hundred Farmers' Institutes during each year. Notwithstanding the appointment of two "conductors" who undertake the making of all the preliminary arrangements for these meetings, and participate largely in the discussions, the necessity of at least one additional member of the staff joining them in actual attendance has had the result of depriving the home work, of both kinds, of more than the equivalent in time of one person throughout the year. So that, instead of the relief urgently needed from additional efficient help, the original work has actually been deprived of the services of at least one person; and as those going out on Farmers' Institute service must be selected from those most competent as the result of long service, the loss so accruing occurs where it can least be afforded.

That the failure to afford the Department this needed assistance has been caused by the financial strait of the University, that in its turn was caused by the unprecedented influx of students, I am fully aware. But that under existing conditions it is physically impossible to accomplish properly the work expected of us, and that in consequence thereof opportunity is afforded for serious criticism by persons so inclined, is equally true; and it is but due to the members of the staff and the Director that this predicament should be publicly stated and acknowledged.

That under such circumstances this report should have been unduly delayed, and that its substance should not show the amount of work accomplished during similar periods in former years, is natural. This has, moreover, rendered it expedient not to confine it strictly to the interval of which it bears the date, but to include in it, in proper connection, a considerable amount of work of later date, which complements and enhances the value of investigations made earlier, and is of such practical value as to call for prompt publication. This is especially true of the portion of the work on soil-moisture and the drought-endurance of crops, which has continued through the two dry seasons just

past, and is not only particularly timely, but should properly be reported upon connectedly.

It has been suggested that the financial stress upon the experimental work might be relieved by the abandonment of one or more of the culture substations. To do this, however, would mean the abandonment of the very basis of our most useful work; for it is chiefly through these stations that we have come, and are coming, into possession of the facts and problems that immediately interest the people of the several sections of the State, and into contact with these people themselves; thus securing their interest and coöperation. Without the knowledge acquired through these substations, we would still be working in the dark, as was the case before their establishment; we would be unable to solve the really practical problems that lie before the farmers of the State, and in our reports and bulletins, and at our Farmers' Institutes, would be able to give the audiences only the perfunctory advice to be found in books written for the regions of summer rains. We ought to have not *fewer* stations, but *several more*, in order to have the many diverse climatic and soil regions of this large State at all adequately represented. No similar diversity is found in any other State; it is far greater than in the co-extensive portion of the Altantic coast, extending from Cape Cod to Charleston; where, under climatic conditions much more uniform, or, at least, more uniformly changing, no fewer than twelve full State stations are in operation. All these stations are investigating more or less the same problems, largely identical with those under investigation in Europe; much of their work is, therefore, a duplication of that done by many others, from the Atlantic coast to the Mississippi River, and even across the Atlantic. I do not think that the stations of the arid region should enter upon these well-trodden paths so long as so many live and immediately important questions, never before under scientific scrutiny, remain unsolved by them. Our people would, in my opinion, have good cause for complaint if we were to follow the precepts of our Eastern colleagues in this respect. Nor do I admit that in thus deviating from the habitual modus we do not, in the most direct manner compatible with our limited resources, fulfill the true objects of the Hatch Act, which was certainly intended, in developing the science of agriculture, to benefit, as directly as possible, the agricultural practice of our farmers. It is quite plain to me that by taking up these practical questions we have "touched with the needle's point" not only the practical, but also the theoretical side of agriculture, which in many respects had assumed a one-sided bias from its development within the limits of one climatic area—the temperate humid; the régime of which being regarded as the normal one, that of the wide expanse of arid climate was almost unconsciously considered as exceptional, if not abnormal; though as a matter of fact it occupies a larger area, and includes within its limits the most ancient civilizations of the world.

I should, therefore, consider the relinquishment of any of our stations at present existing as a most unfortunate, retrograde step, which, moreover, in a not far distant future would have to be recalled in obedience to the imperative demands of the farming population, from whom suggestions for the establishment of additional stations, with offers of land for the purpose, are constantly being received. Nothing but the most imperative necessity should induce us to abandon the vantage ground,

active work, and improvements already made at heavy cost, merely to relieve what we have reason to hope is but a temporary pressure.

But since that pressure has in the main arisen from the superimposition of the Farmers' Institute work upon the already overloaded staff of the college and station, it would seem but proper that that branch of the work should be otherwise provided for, as has been done in nearly all the other States where such institutes are held. So far from curtailing them, I would have them materially increased and strengthened by the aid of a special legislative appropriation, which, after the active interest that has been excited throughout the State, it should not be difficult to obtain; not by solicitation from the University authorities, but through the potent influence of the farmers themselves, large numbers of whom have been reached and become deeply interested, whose vote counts heavily in the political field, and whose expressed demand would not be lightly disregarded.

What is true of the general culture substations should, in my opinion, apply as well to the two forestry stations, which, with the increased interest in forestry now prevailing, should not only be maintained but further developed. This, however, is an impossible task with their present financial endowment, which barely suffices to maintain the *status quo* by employing workmen in charge, to protect the property and give the most needful care and cultivation. Of these two substations, the one at Chico, being located so as to be fairly representative of the upper Sacramento Valley, should be expanded into a general culture station for that important region, which is now wholly unrepresented in our culture work. The same should, whenever possible, be done for the Santa Monica forestry station, which properly represents the coast region of Southern California. The report of Inspector Shinn on these substations gives some details regarding these points.

In view of the close inter-connection of the several activities of the College of Agriculture, I feel justified in once more calling attention, in this place, to the just and persistent demand of the dairymen of the State for the establishment of a *practical dairy school*, such as have been so successfully established in connection with the Universities of Wisconsin, Cornell, and others. The peculiarities of our climate call for some variation in dairy practice as well as in other agricultural branches; hence experimental work in this connection, for which thus far there have been no facilities, should go hand in hand with such a school. The late appointment of an instructor in this branch is an important step forward, but should be supplemented by the establishment of a practical school.

Another grievous deficiency exists in the matter of instruction in agricultural manufacturing industries; prominent among which is the beet sugar industry, in which this State now stands foremost in America. In the absence of the means for employing a specialist for instruction in this industry, I have endeavored to supply the deficiency personally; but the additional work having proved too great a weight to bear, I am reluctantly compelled to leave this pressing want unsupplied. For the present, therefore, our students will for the study of this subject have to resort to other universities, in States much less interested than is California, but where special courses on this industry have been established during the last few years. When we consider that for a quarter of a century California was the only State in which a beet sugar factory

maintained itself, and that this Station has for nearly the same length of time been foremost in advocating the special adaptability of California to beet sugar production, this particular gap in our means of instruction seems somewhat mortifying. I earnestly hope that before long, means may be found to supply this glaring deficiency.

Another branch in which instruction should speedily be provided is *forestry*, which now so deservedly occupies a prominent place in public attention, owing largely to its intimate connection with the all-important subject of irrigation. The many recent demonstrations of public interest in this matter, and the formation of several strong associations for the promotion of forest preservation and rational management, are strong intimations that if the University is to lead, as it should, in all matters pertaining to technical as well as general education, then this important topic cannot much longer remain unrepresented among the technical courses of instruction.

That the wide scope now covered by Prof. Wickson's courses (general agriculture, horticulture, and stock-breeding) should as soon as practicable be subdivided as it is in other agricultural colleges, hardly requires more than mention. But I must in this connection reiterate what I have annually said for twenty years, viz, that a *veterinarian* qualified to respond to the inquiries and investigate the problems constantly coming before us, should either be appointed in connection with this Department, or that the veterinary college at San Francisco should undertake these functions. This is and has always been a grievous deficiency.

Among the greatest immediate needs of aid in the experiment station work is an assistant in the entomological work, who should be qualified to take charge of Prof. Woodworth's classes when the latter is absent or otherwise necessarily engaged in station work. It would not, probably, be possible to obtain a person who could at once successfully replace Prof. Woodworth in the practical and institute work; but it would be comparatively easy to find some one capable of materially relieving him in the routine work of the laboratory and lecture room, thus enabling him to satisfy the public demand for information and investigation without the excessive strain now imposed upon him.

Additional assistance in the chemical laboratory is also urgently needed. The chemist appointed should not be a novice, but a man capable of independent investigation of the many complex problems constantly presented to us. At present most of this work devolves upon Prof. Loughridge, who has only of late been relieved to some extent of the analytical routine work by the reduction of the viticultural branch, consequent upon the failure of the legislative special appropriation which until lately served to maintain active work in that line. Instructor G. E. Colby now acts as general (instead of viticultural) assistant in the agricultural laboratory, and it has thus become possible to deal more promptly with the current demand involving the examination of soil and other specimens. The physical investigation of soils in connection with their geological derivation and chemical composition, together with the entire charge of the editorial revision of bulletins and reports, and extended correspondence, constitutes a heavy burden of work on Prof. Loughridge, which calls for relief in other directions, in order to enable him to pursue to a reasonable extent the

research which, with class instruction, constitute his proper sphere of work.

As matters stand it is largely due to the intelligent assistance given by advanced students (for which due credit is given in the text of the report) that we have been enabled to carry out research work to some extent. While such participation in research is of great advantage to the student as well, it is unfortunately too liable to interruption and incompleteness to be generally satisfactory.

In this connection, as well as in view of the many peculiarities of the Pacific Coast climate and its manifold bearings upon industrial possibilities and development, instruction in meteorology and climatology is urgently called for.

Respectfully submitted.

E. W. HILGARD.

February, 1900.

As, owing to inadequate provision for University printing by the last Legislature, the printing of the report has been still further delayed from the above date, to August, it has become necessary to still further modify and reduce its contents, so as to bring its publication within the financial resources of the University. A number of investigations, properly falling within its scope, as well as the re-publication of revisions of bulletins formerly published (of some of which a number of copies are still available), have been laid aside for future use, reducing the present issue by 150 pages. For the sake of proper connections of subjects, moreover, some much later work has been utilized. This course was thought so much the more advisable, as the inevitable delay in the availability of legislative appropriations to be made at the coming session, renders the date of the issuance of the report next in order, a matter of considerable uncertainty. However regrettable, this state of things cannot apparently be remedied by any means within the financial ability of the University.

E. W. H.

August, 1900.

I.

GENERAL REPORTS

OF THE

COLLEGE OF AGRICULTURE.

PREPARATORY TEACHING IN AGRICULTURAL COLLEGES.*

By E. W. Hilgard.

In discussing the question of "The propriety and legality of including preparatory work in the instruction in the Colleges of Agriculture," i appears to me that it is first necessary to define what is meant by "preparatory work."

In so far as the first "Morrill Act" distinctly says that the chief instruction to be given in the colleges shall be in "the *sciences* bearing upon agriculture and the mechanic arts," it seems to me clear that no grade of instruction that does not include these sciences can legally be given in them. The kindergarten, the common, and the grammar school studies, as at present understood almost throughout the United States, cannot therefore find a place in them. The doubt only begins with the high school grade, in which more or less of scientific study is very generally included; and will increasingly be so included as in the progress of time the commanding importance of scientific knowledge for the understanding of what have now become everyday appliances and household necessities, forces itself upon the attention of even the most conservative educators and advocates of the old régime. An additional force tending in this direction is the tendency of the universities to raise the grade of undergraduate admission, compelling high schools desiring to be "accredited," to include within their curriculum such subjects as elementary chemistry, physics, and botany.

The question confronting the agricultural colleges, then, is whether they shall *aid* in the struggle of the sciences for a place in preparatory instruction, or by including the elements of the sciences in their own curricula, bid for numbers rather than for a high grade of scientific and technical instruction; and shall to that extent weaken the other schools in the struggle for the rights of scientific teaching in the lower grades. Also, whether in so doing they are not violating at least the intention, if not the letter of the law, by scattering their means upon that which should properly be done in the other schools.

This raises the vexed and oft-discussed question whether the agricultural colleges should, or were designed to, educate the *mass* of farmers' sons, or whether, on the contrary, they were intended to educate, chiefly at least, the agricultural experts and leaders of progress. I think that the drift of the development of the colleges in the older States, as well as the consensus of opinion among the older members of this Association, points toward the latter view as the one that is ultimately to prevail. We have seen the colleges in many States coming in, in obedience to popular clamor, with low-grade courses of instruction and the enforcement of mere manual exercise as parts of the prescribed course. I was at one time myself connected with an institution pursuing this policy for a short period—short because the students soon left, they and their

*Read at the meeting of the A. A. A. S. in Minneapolis, July, 1897.

parents agreeing that it was not worth their while to stay away from their labor on the farm, if they were to do very nearly the same things at the college farm. The same experience has been repeated, over and over again, in the popular colleges of the newer States; and at the meeting at Denver three years ago, it appeared to me that manual labor had but very few defenders among those engaged in teaching. The same, I think, is coming to be the case with the low-grade courses of instruction; the demand for instruction of the university grade is becoming more and more urgent, even to the extent of a demand for the establishment of classical courses alongside of the technical ones. In other words, our agricultural colleges are slowly but surely developing into technical universities, with courses prevalently for the education of the experts, teachers, and other leaders of progress, who shall act as centers from which the advance of progressive agriculture is to radiate into the rural communities. In some other cases, on the contrary, the absence of other opportunities for secondary education threatens to reduce the agricultural colleges to mere local high schools.

It will be asked how, then, the benefits of agricultural science are to accrue to the bulk of the farming population and their sons. I reply that in this as in other kinds of instruction, there is an absolute necessity for *graded schools;* and that there is no more reason why the bulk of the farming population should come to the agricultural colleges, than why the mass of the rest of the population should come to the universities for their education, instead of going to the public schools.

Such graded agricultural schools are in actual existence in Europe; in France they form part of the common school system; which, however, does not compel *all* pupils to be taught in precisely the same manner, the subjects being different for rural and urban communities. There is no sound reason why education should not be adapted to the needs of the community in which it is bestowed. The customary uniformity of text-books throughout each State has thus far prevented this adaptation, very much on the same ground that it has prevented religious instruction. But surely the doctrine of equality in its application to education to this extent, injures seriously the very classes it was specially designed to protect and benefit; it is an injury to them in preventing their being educated to the best advantage for their future pursuit. The city child needs for its future career a different kind of information from that which may be usefully imparted to the child in the country. Why then should both be compelled, on purely theoretical grounds, to undergo the same process of development?

It is often urged against the practicability of science-teaching in the common schools and grammar schools, that the children do not seem to profit by it; and this is unfortunately too true. But the fault does not lie in the impossibility of so teaching these subjects that they shall be both useful and interesting to the children, but rather in the failure in the teachers to properly appreciate the manner in which they must be taught.

Text-book teaching is the bane of all instruction in science. Yet this unfortunately is all that most of our common and grammar school teachers, who have been educated at the Normal schools, are able to do. With rare exceptions it is only the university-trained men and women who, knowing considerably *more* than they expect to teach, and emancipated from the text-book methods, are markedly successful as science teachers in the lower schools; and, owing to the uncertainty of their

tenure of office, it is not at all likely that the better preparation required for the purpose in question will very generally be obtained by these teachers within any short period of time.

Those of us who attend Teachers' Institutes cannot but have been struck with the large prevalence of special prescriptions and patent devices for instilling into the child's brain, in the shortest possible time and with the least trouble to the teacher, certain subjects or branches of the course; resulting but too commonly in mere mechanical memorizing without any proper understanding on the part of the pupil, who will frequently in after-life, when confronted with the actual application of the subject supposed to have been learned, find with surprise in some recess of his memory, words or rules heretofore meaningless, but now assuming their proper place in his store of knowledge. Such teaching as this, and worse than all, the teaching of some branches such as grammar, the metaphysics of language, long before the child's mind is qualified to take in and utilize, but merely to memorize it, involves an enormous waste of precious time, compared with which that which would be necessary for instruction in the rudiments of natural sciences would be but a small fraction. It is of course idle to hope that this perfunctory method of teaching, and the qualifications of the teachers, will be rectified within any short space of time; we must therefore look in another direction to obtain the much desired elementary instruction in natural science.

In so far as the common and grammar schools are concerned, I think the end can be attained by the appointment of thoroughly competent teachers, who shall, instead of being attached to any one school, be a kind of circuit rider, so to speak, for instance in one county, within which he shall visit the common schools as well as the grammar schools from time to time during the year, giving in each a short course of any such branch of natural science as may be most readily available in the locality. Such courses would serve as an example and incitement to study both for the teachers and for the pupils; not merely as regards the subject-matter, but to the teachers specially with reference to the methods of presentation. The expense of the employment of such comparatively high-priced competent men would thus be sufficiently distributed to render it available to the schools of a considerable region, and would serve to promote greatly the interest of the pupils in the country in farm and farm-work. In the course of time it would do away entirely with the kind of instruction which all of those who have taught the sciences have learned to reprobate in the "Fourteen Weeks Courses," which two decades ago were supposed to be the very perfection of instruction in the natural sciences; but have on the contrary proved an obstacle to their introduction into the lower schools, because of their recognized utter uselessness; apart from the fact that, being written by persons ill qualified as specialists, they contain a great deal of matter either irrelevant or absolutely incorrect.

It seems to me that it is in this way that we can approach most successfully the solution of the problem of such preliminary instruction in natural sciences as will enable the agricultural colleges to do the proper kind of science-teaching intended by the Morrill Act. All probably agree that preparatory education outside of the sciences bearing on agriculture and the mechanic arts should not be given in the agricultural college. It is only the lack of proper preparation in the sciences that has at all raised the question that forms the subject of this paper.

FARMERS' INSTITUTES.

By Edward J. Wickson.

Farmers' institutes are at the present time the most prominent means of university extension in agricultural lines in the United States and Canada. Nearly all the States provide for them, generally as a stated branch of the work of the State universities and colleges of agriculture, and under the direction of these institutions. When other control is provided, as is the case in a few States, the professional agricultural instructors are still a prominent factor in the prosecution of the work.

COLLEGES, STATIONS, AND FARMERS' ASSEMBLIES.

Systematic effort for the advancement of agriculture through dissemination of accurate knowledge of conditions, means, and materials has proceeded in this country in three main lines: (1) The establishment of agricultural colleges; (2) the establishment of agricultural experiment stations; (3) the promotion of farmers' institutes and other methods of university extension in agriculture. Each of these progressive steps is related to the others; each enriches and promotes the work of the others. Taken together they promise, when each is brought to its highest development, to constitute a complete system for the efficient promotion of agriculture, both as a science and as an art, and to advance the agriculturist as the nature of his calling demands.

Briefly characterized, the needs and the opportunities of the three agencies indicated above are these: The agricultural colleges needed pupils and needed also actual experimental truth about agriculture. Without popular recognition of their possession of the latter, they could not secure the former. The work of the experiment stations disclosed great volumes of truth which, in amount and practical importance, surprised even the investigators themselves. Evidently, current agricultural practice needed revision as to its tenets and its methods. This truth pressed for announcement through college work, but pupils were few and the outlet inadequate. It found utterance through every means of publication, and the reading agricultural public was aroused and incited to better and more profitable practice. The more intelligent agriculturists were wonderfully assisted, but the great mass of producers was unreached. Free public assembly and entertaining speech demonstrated their ability to outstrip the printed word in commanding popular attention. The applicability of the truth to public need was demonstrated in higher market returns for more valuable products, and in more economical production of them. General recognition of this fact created a demand for still wider declaration of the truth. Popular interest in college and experiment station increased, and practical men who had scouted the teaching of the instructor in agricultural science began to listen, to weigh his words, and to think for themselves in lines he marked out for them.

The farmers' institutes afforded the opportunity for instructors and practical men to meet face to face; the invitation to discuss all propo-

sitions freely and frankly and in the plainest terms brought the teacher and the farmer side by side on the same platform of mutual interest and cordiality, and each recognized the other's love of truth and hatred of error. The agriculturist began to discern as never before the scope of his calling and its relation to higher industrial and scientific thought, and began to aspire to an understanding of that thought. His interest in college and station increased; his support of them became more earnest and pointed as it began to rest upon actual understanding of their particular value, and not upon generalities and platitudes.

INSTITUTE WORK A PROPER UNIVERSITY EFFORT.

These statements will, it is hoped, make it plain that there is the closest inter-relationship between the college, the station, and the public assembly of agriculturists. All are clearly factors in agricultural education, and each is dependent upon the other in the quest of truth in agricultural science and practice, and in demonstration of it for the public benefit. For this reason all are entitled to place in the system of university education, and not to provide for all is to close plain avenues for university progress in public esteem and valuable achievement. The farmers' institute is but a larger classroom of the university. As its work proceeds by declaration of the results of original investigation; as it provides for discussion of these results by both teacher and pupil, and as it requires, usually, stated preparation of his own contribution to the conference on the part of the farmer, it alligns itself at points with customary methods of university instruction, and deserves recognition as work of university grade. It is not the elementary work of the school, nor the prescribed work of the college; it rises at once by its very nature and by virtue of the advanced standing of those who participate in it, to the very highest themes and to the frontiers of the sciences involved in its special industry. It is clearly of university character, and it reflects its light and inspiration upon all the lower lines of study and investigation which lead up to it. How great its influence must be can be judged by the fact that during the present year not less than four hundred and fifty thousand American agriculturists have been gathered together in assemblies of this nature.

THE WORK IN CALIFORNIA.

The Regents of the University of California have demonstrated their faith in this phase of university extension by providing the means for its prosecution each year since 1891. In California, as in other States, the work progressed slowly at first because it required time to inform the people of the character and purposes of the new form of assembly, but wherever this knowledge went popular interest and support were commanded. In the spring of 1896, a committee of Regents, consisting of Messrs. Reinstein, Black, and Rodgers, who were charged to make inquiry into the relations of the University to the interests and industries of California, submitted a report which was widely printed at the time. Among other progressive measures, it was urged that university extension in the form of farmers' institutes should be more vigorously promoted as a means of increasing the efficiency of the College of Agri-

culture and bringing it into closer relationship with the farmers of the State.

The outline of the first year's work under this broader plan is given in the Report of this Station for 1896–7. The success of the fifty institutes held during that year induced the Regents to make provision (July 13, 1897) for wider and more systematic work during the fiscal year 1897–8. A new University department was created under the title "The Department of University Extension in Agriculture," of which the writer was designated as "Superintendent." In view of the large area of the State, and the distances to be covered in the promotion of the work, two assistants were provided, to be known as "Conductors of Farmers' Institutes." D. T. Fowler (U. C. 1869) was chosen for the region north of Tehachapi, and A. J. Cook (Professor of Biology in Pomona College) for the region south of Tehachapi.

INSTITUTES HELD IN 1897–8.

Under this arrangement and with the provision, on the part of the Regents, that not less than seventy meetings should be held during 1897–8, the work began in August, 1897, and at the end of June, 1898, seventy-eight institutes had been held, as follows:

West Palmdale	Etiwanda	Oroville	St. Helena
Covina	Galt	Ione	Hollister
Long Beach	Auburn	Kingsburg	Niles
Montecito	Petaluma	Modesto	Newman
Nordhoff	Whittier	Guinda	Westminster
Santa Paula	Winters	Rialto	Escondido
Healdsburg	Fresno (2)	Martinez	Livermore
Paso Robles	Hanford	Porterville	Chino
Morgan Hill	Sebastopol	Dinuba	Compton
Newcastle	Corona	Sanger	Hanford
Watsonville	Merced	Arroyo Grande	Gilroy
Danville	Highlands	Claremont	Easton
San Francisco (2)	Selma	Corning	Monrovia
Santa Rosa	Los Angeles	Malaga	Fernando
Lakeport	Temperance	Soledad	Ferndale
Ukiah	Elk Grove	Madera	Hydesville
La Cañada	Loomis	Willows	Arcata
Half Moon Bay	Grass Valley	Colusa	Eureka
San José	Woodland	Florin	Pacific Grove

In 1898–9 eighty-six institutes were held and in 1899–0 about eighty, of which lists will be given in later reports.

NOTES ON THE MEETINGS.

The design has been to distribute the meetings throughout the State as evenly as possible. This has been controlled, however, to some extent by the degree of local interest; and inability to secure interest and coöperation accounts for the omission of some important localities from the foregoing list. Repeated efforts both by ourselves and resident friends of the University have sometimes failed in this respect. On the other hand, most localities extend cordial invitation and have excellent arrangements. Naturally our work is directed toward those who manifest the warmest appreciation and the readiest participation. Sometimes important places can be ultimately reached by means of the favorable impression disseminated throughout the region by successful meetings in adjacent localities.

The meetings are usually well attended and the interest is generally keen—increasing as the sessions advance and the methods and the aims of the work are better understood. The attendance varies widely in different localities and sometimes at different sessions in the same locality. A cautious estimate is that, on an average, 200 different persons attend each institute and that we have thus reached nearly 16,000 people at the 78 institutes listed above. The earnest approval which the work secures is shown by the general interest, by the discussions at the meetings, and by the resolutions which are frequently adopted.

Experience in California agrees closely with that described by institute managers in other States as to the importance of requiring the localities desiring institutes to bear the expense of hall rent, printing, and other local preparations. This local responsibility insures effort and secures proper accommodations for the meetings and wide announcement of them. We also expect that a good part of the time at each meeting will be occupied by local speakers whose statements disclose topics of chief interest and enable the University lecturers to minister more directly to local interest, and to be of assistance in discussing local needs and difficulties.

The lectures by the University representatives are largely from a theoretical point of view, and deal with principles underlying practice. To make the institutes directly influential and helpful there must be plain exposition of correct practice. This feature lies at the very foundation of the efficacy of the institutes in increasing and improving products and enlarging farmers' incomes. In the Eastern States where institutes have attained the widest success and popularity, a large share of the time is devoted to straightforward talks and discussions on practice. Our California institutes must be well provided with this element of strength to be widely useful. For this reason it is desirable to have the services of a number of our most successful California farmers and fruit-growers to accompany the University representatives, and complement the lectures with such practical talks as have been mentioned. We have secured the help of many with no cost except for traveling expenses. In other cases a payment of a small *per diem* has been made for the few days each man is actually employed.

REQUIREMENTS UPON THE COLLEGE STAFF.

Concerning the relation of the college staff to institute work in this State the following claims are made:

(*a*) That in California the institutes are costing less than at the East;

(*b*) That a much greater part of the work is being done by the staff of the College of Agriculture;

(*c*) That this fact occasions absences which are infringing upon the efficiency of the work at Berkeley:

(*d*) That the dissemination of knowledge of college and experiment station work which the institutes accomplish is largely increasing the demand for investigation and correspondence, while at the same time the staff, by reason of repeated absence, is less able to meet the demand.

In support of these claims it is fitting to compare Eastern methods and expenditures with our own. I am able to make this comparison with several Eastern States by the kindness of Superintendent McKer-

row, who conducts the work for the University of Wisconsin. The information thus secured I tabulate for sake of comparison, as follows:

State.	Appropr a-tion.	Number of Institutes.	Cost, average.	Work by University Staff.
New York	$15,000	250	$60	2.5 per cent.
Wisconsin *	7,000	125	56	5 per cent.
Minnesota†	10,000	50	200	12.5 per cent.
Ohio	11,000	175	63	5 per cent.
Indiana	5,000	90	55	5 per cent.
California	3,600	78	45	35 per cent.

* Wisconsin has a State appropriation for institutes of $12,000 per annum, but uses $5,000 of it for publication of a report.
† Minnesota institutes are about twice the length of those in other States.

This tabulation shows that California holds institutes at less cost than any of the States named, and is enabled to do it because so large a share of the work is done by the staff of the College of Agriculture. This 35 per cent does not include the work of the two conductors employed by the Regents for this special purpose, but relates only to the speakers from Berkeley, who receive no compensation for this extra work. Superintendent McKerrow says in his letter: "In none of these States is more than one eighth of the work done by the college professors, and in most of them not over one twentieth to one fortieth. In the University of Wisconsin it would be impossible for the professors of the Agricultural College to carry on the institute work with their own."

It should be noted that in the Eastern States named, and in many others, the funds for farmers' institutes are specially appropriated by the State Legislatures for that purpose. I believe that there is no State in which the cost is borne by so large an appropriation from the general funds of the University as in California. The attitude of the Regents in approval and promotion of the institutes is unquestionably very satisfactory to the people of California, and a measure to provide for extension of the work by special appropriation would receive the hearty support of our agricultural classes.

INSTRUCTION IN EXTENSION WORK.

There was established in the University in August, 1897, a regular course of instruction in university extension in agriculture, in which all methods and phases of the effort are expounded and discussed. This is designed to make agricultural students familiar with the scope of the work and the means employed, so that they may carry this knowledge with them to their respective homes, and thus serve as new centers from which influence may be extended. So far as I am aware, the University of California is first to undertake a distinct course of systematic instruction in this branch. It is proving very interesting, and the discussions, in which the pupils freely participate, continually involve consideration of the general relations of the University to the public, and minister to broader conceptions of these relations than students usually attain.

II.

REPORT

OF THE

AGRICULTURAL EXPERIMENT STATION.

1. SOILS, LANDS, AND SOIL-MOISTURE.

No. 1963. *Dark valley soil*, from near Willows, Glenn County. The land is devoted to the culture of wheat. These soils are derived from the sediment brought down by the creeks flowing from the cañons on the northwest of Willows; they are yellowish clay loams, with more or less gravel, and when dried in lumps they do not readily yield to water, though crushed between the fingers with comparative ease. Analysis was made by E. R. Lyman, a student in the Agricultural Laboratory.

Coarse materials > 0.5^{mm} diameter	none.
Fine earth	all.

Analysis of Fine Earth.

Insoluble matter	38.00	63.43
Soluble silica	25.43	
Potash (K_2O)		1.06
Soda (Na_2O)		.30
Lime (CaO)		1.26
Magnesia (MgO)		2.47
Br. ox. of manganese (Mn_3O_4)		.12
Peroxid of iron (Fe_2O_3)		10.48
Alumina (Al_2O_3)		12.35
Phosphoric acid (P_2O_5)		.17
Sulfuric acid (SO_3)		.07
Water and organic matter		8.69
Total		100.40

Humus	3.61
Nitrogen in humus	6.05
Nitrogen in soil	.22
Phosphoric acid in humus	.03
Potash in humus	.03
Hygroscopic moisture (absorbed at 15° C.)	11.66

The result of the analysis shows the soil to be unusually rich in potash and well supplied with phosphoric acid; the lime, magnesia, humus, and nitrogen are also present in large amounts, thus making this a most excellent soil for wheat, alfalfa, and other general cultures, except where underlaid by heavy clays, such as those that prevail beneath the "gooselands" a few miles distant.

No. 2195. *Tule soil* bordering the Sacramento River near Colusa, Colusa County. Sent by S. V. West, Colusa. The soil is a black clayey loam, "very brittle when dry; and cakes and curls up on the surface." The analysis was made by E. R. Lyman.

Coarse materials > 0.5^{mm} diameter	very little.
Fine earth	chiefly.

Analysis of Fine Earth.

Insoluble matter	58.51	74.62
Soluble silica	16.11	
Potash (K_2O)		.49
Soda (Na_2O)		.12
Lime (CaO)		1.50
Magnesia (MgO)		1.72
Br. ox. of manganese (Mn_3O_4)		.05
Peroxid of iron (Fe_2O_3)		6.55
Alumina (Al_2O_3)		9.17
Phosphoric acid (P_2O_5)		.08
Sulfuric acid (SO_3)		.04
Water and organic matter		5.35
Total		99.69
Humus		2.07
Phosphoric acid in humus		.01
Potash in humus		.03
Hygroscopic moisture (absorbed at 15° C.)		7.47

This soil closely resembles in its composition the alluvial lands and tules of the Sacramento River elsewhere. It has a fair content of potash, phosphoric acid, lime, and magnesia, and its absorptive power for moisture is excellent.

No. 2187. *Sandy soil* from the lowest part of the land of the Salvation Army Colony, Fort Romie, west of Soledad, Monterey County. Taken 24 inches in depth. The soil is a very sandy loam, dark gray in color, and characteristic of a large tract of land in this portion of Salinas Valley. It reaches westward for several miles in a broad plain, sloping slightly from the Salinas River toward the hills. It is many feet in depth, permitting of deep root-penetration; it is rich in plant-food, and with proper attention to moisture-supply to the rootlets should yield good crops. Water percolates downward in it quite freely. The analysis was made by F. N. Smalley, a student in the Agricultural Laboratory.

Coarse materials $>$0.5^{mm} diameter	1.50
Fine earth	98.50

Analysis of Fine Earth.

Insoluble matter	68.50	77.44
Soluble silica	8.94	
Potash (K_2O)		.92
Soda (Na_2O)		.62
Lime (CaO)		1.22
Magnesia (MgO)		1.93
Br. ox. of manganese (Mn_3O_4)		.26
Peroxid of iron (Fe_2O_3)		6.07
Alumina (Al_2O_3)		6.56
Phosphoric acid (P_2O_5)		.11
Sulfuric acid (SO_3)		.31
Water and organic matter		4.93
Total		100.37
Humus		.97
Nitrogen in humus		11.10
Nitrogen in soil		.11
Phosphoric acid in humus		.07
Hygroscopic moisture (absorbed at 15° C.)		3.78

The analysis shows richness in the three important elements—potash, nitrogen, and phosphoric acid, as well as in lime and magnesia. The unusual amount of sulfuric acid is due to the presence of particles of gypseous clay in the soil.

SANTA MARIA AND SISQUOC VALLEYS AND NIPOMO MESA.

By R. H. Loughridge.

The Santa Maria River, on leaving its upper, or Cuyama, valley, flows through a narrow cañon, and turns sharply southward to its junction with Sisquoc River, or creek, where it again is deflected almost at right angles westward toward the ocean, and occupies a broad bed at the foot of the bluffs that border the Santa Maria Valley on the north. The two valleys, Santa Maria and Sisquoc, thus lie in a direct line with each other, separated at the junction of their respective streams by "Fugler's Point," a sharp point of high mesa that reaches northward from the southern hills to within less than one half mile of the northern bluffs; the beds of the two streams occupy nearly all of this narrow space.

The two valleys differ from each other in physical features very materially. In the Sisquoc, the stream flows through the central part of the valley, bordered by the low valley on the south reaching to the hills, while on the north a mesa, one half to a mile wide, lies between it and the hills. The reverse is true in the Santa Maria Valley; for the river hugs the bluffs of the high mesa lands on the north, leaving a low and broad plain stretching southward for some miles to low mesas.

In its lithological features the country varies greatly. On the east the hills are formed of siliceous clay slates, which stand nearly vertically on edge, are interspersed with seams of flint, and hold occasional lumps of asphalt. Magnesian salts, chiefly sulfate (epsom salt), frequently appear on the rock surfaces as an efflorescence, and the waters of a spring in Tepusquet Cañon are highly charged with this mineral.

To the westward and forming the border of the hills lying east of the town of Santa Maria, there is a belt of trachytic rock, trending northwest, and strongly resisting disintegration. Fugler's Point, already mentioned as the point of division between the two valleys, is formed of this hard rock.

To the west of this belt of trachyte lie the high Nipomo mesa lands, forming a broad plain from the foot of the hills to the ocean. They are built up of material transported from the east and deposited in beds of varying thickness and character, as shown in the bluffs bordering Santa Maria River, where the soil is underlaid by fifty feet of an indurated mass of coarse yellow sand and pebbles. Near Fugler's Point, in the south bluff of the Santa Maria Valley, the following stratification was seen;

Soil	3 feet.
Indurated yellow sand	6 feet.
Fine gravel and sand, more or less compact	3 feet.
Coarse gravel and cobblestones, interstratified with yellow sand in horizontal beds	13 feet.

Large bowlders, some of them as much as two feet in diameter, lie around in the valley. The bed of the Santa Maria River is very broad and filled with these loose bowlders, gravel, and sand.

Sisquoc Valley has a length of eight or ten miles, and a width of from one-half to one mile, narrowing suddenly at Fugler's Point, where it merges into Santa Maria Valley. The stream occupies about the middle of the valley, and is quite wide, with gravelly bed and is bordered by low, flat lands. The latter rise but slightly to the hills on the south, while on the north a wide mesa reaches from the stream to the hills.

The lands on the south vary from sandy near the river to a dark rich gravelly loam near the hills, having a depth of about six feet and underlaid by gravel and cobblestones as shown in a well, a couple of miles from Gary, in which water was found at sixteen feet. Saltgrass is a prominent growth in both this and the Santa Maria Valley.

The mesa on the north of the river is about a mile wide in its extreme western part, and is more or less rolling in surface. The eastern part toward Tepusquet Cañon, five miles from Fugler's Point, has a reddish sandy soil, which changes to a black gravelly adobe at three miles, especially in front of the large cañons that open out from the hills. Beneath the surface at ten or fifteen feet are beds of gravel, etc. This mesa is generally under cultivation in grain and orchards of apricots, prunes, and walnuts. It was interesting to note in the dry year of 1898 that the apricots were in good condition, while the prunes were suffering severely; thus illustrating the fact developed by observations in other localities of the State that these two growths differ in the amount of water needed for full vigor.

Santa Maria Valley.—The valley that borders the Santa Maria River is several miles wide at the town of Santa Maria, and widens out to westward. To the east it narrows more and more, until at Fugler's Point, nine miles distant from Santa Maria, it is less than one half of a mile wide, being almost closed by a sharp point of mesa that reaches out from the southern border nearly to the river bed on the northern side of the valley. The river itself lies along the northern side of the valley in a broad and shallow bed filled with sand, gravel, and cobblestones. The bluffs on this northern side rise abruptly from the river's edge to an elevation of about seventy-five feet to the broad and rolling Nipomo mesa. These bluffs are formed largely of whitish clays and claystone, covered with a thick deposit of indurated sand, in places some fifty feet thick.

The valley seems to have been widened in time by the continual impact of the stream upon this north bluff, wearing it away and carrying the débris down toward the ocean, the surface of the valley being subsequently covered with a sandy loam by general overflow from the mountains above, coming through the gap at Fugler's Point. Such an overflow would naturally have a swifter current in the neighborhood of that point than farther down the valley, and the material deposited near the point would be coarser than to westward; this we find to be the case.

The low mesa which in the Sisquoc Valley lies on the north side, is in this valley on the south, and has an elevation of about fifty feet above the valley. Its surface is also rolling, and has a gray sandy loam soil, largely under cultivation.

As already stated, the soils of the valley have a reddish sandy and gravelly character, from Fugler's Point westward to within four miles of the town of Santa Maria, where they change to a grayish character.

Still westward toward the beet sugar factory it is more loamy in its nature, and a sample taken of the surface foot shows by analysis to have excellent percentages of available plant-food ingredients.

Nipomo Mesa.—North of the Santa Maria Valley the country rises seventy-five feet abruptly from the river to the high mesa which reaches thence northward for about fourteen miles to the Arroyo Grande Valley, and in width from the foot of the hills to the coast, a distance of about three miles.

The bluffs that border the Santa Maria River show some fifty feet of indurated sand and gravel, hard and compact, and in turn underlaid by clay slates.

The soil of the mesa is largely of a sandy character, especially on the coast side. The sample whose analysis is given below is of this character. It was sent by Mr. C. H. Reed and presumably represents the soils of that region. Its subsoil at three feet is very similar in character. Along the eastern side of the mesa bordering the hills there is a belt of stiff black adobe, a mile or less in width, and reaching from the Santa Maria bluffs northward to two miles beyond Nipomo, a distance of about nine miles. The adobe is from two to four feet thick, and underlaid by a yellowish clay with layers of gravel.

The following analyses have been made of the valley and mesa soils:

No. 2080. *Santa Maria Valley soil*, from near the sugar factory, four miles west of the town of Santa Maria, Santa Barbara County. Sample taken a foot in depth. The analysis was made by F. J. Snow.

No. 1958. *Sandy mesa soil*, from Nipomo, San Luis Obispo County. The sample was sent by C. H. Reed, and the analysis made by E. R. Lyman, a student in the Agricultural Laboratory.

Analyses of Santa Maria Valley and Nipomo Mesa Soils.

	Santa Maria Valley. No. 2080.		Nipomo Mesa. No. 1958.	
Coarse materials >0.5mm diameter				13.00
Fine earth				87.00
				100.00
Chemical Analysis of Fine Earth.				
Insoluble matter	82.03	85.55	90.95	94.17
Soluble silica	3.52		3.22	
Potash (K_2O)		.55		.13
Soda (Na_2O)		.22		.16
Lime (CaO)		.34		.07
Magnesia (MgO)		.76		.18
Br. ox. of manganese (Mn_3O_4)		.02		------
Peroxid of iron (Fe_2O_3)		6.45		1.92
Alumina (Al_2O_3)		1.11		1.81
Phosphoric acid (P_2O_5)		.16		.03
Sulfuric acid (SO_3)		.08		.03
Water and organic matter		4.65		1.76
Total		99.89		100.26
Humus		1.64		.85
Humus, ash		.64		14.45
Nitrogen in humus		5.36		.12
Nitrogen in soil		.09		------
Available potash } citrate method.		--------		.014
Available phosphoric acid } citrate method.		.03		.02
Hygroscopic moisture (absorbed at 15° C.)		3.33		1.24

The loam soil of the Santa Maria Valley, with proper moisture supply, should be productive for all crops suitable to that climate, for it is well supplied with potash, phosphoric acid, and humus. Its lime content is low. The application of fertilizers to this soil should not be necessary for many years under proper care. Its physical analysis, given below, shows it to be easily tillable.

The Nipomo mesa soil is lacking in sufficient potash, phosphoric acid, and lime, for durability. In fact, these with nitrogen compounds applied in fertilizers, seem to be loudly called for. Green-manuring would be highly beneficial. The plant-food percentages are the lowest thus far found in California soils, even in soils fully as sandy; in this respect the land closely resembles the sand hummocks of Florida, and is quite exceptional.

Mechanical Analysis of Santa Maria Valley Soil.

Hydraulic Value.*	Diameter of Grains.		Percentage.
64mm	0.50mm	Very coarse sand	5.95
32	0.30	Coarse sand	14.15
16	0.16	Medium sand	10.60
8	0.12	Fine sand	8.26
4	0.072	Coarse silt	12.35
2	0.047		10.30
1	0.036	Medium silt	8.15
.5	0.025		3.70
.25	0.016	Fine silt	1.80
<.25	0.010	Very fine silt	13.57
.0023	?	Colloidal clay	9.42
		Total	98.25

Maximum water capacity, 23.5 per cent. It would require about 4½ inches of rainfall to saturate an acre-foot of this soil.

SOILS OF EAST HIGHLANDS, SAN BERNARDINO COUNTY.†

By E. W. Hilgard.

These soil samples represent, not very distinctly in one case, two of the three chief soil varieties found in the upper San Bernardino Valley. They were sent by Mr. Wm. M. Bristol.

One (No. 2126 of the table) is the light, granitic land built up from the débris washed from the slopes of the Sierra Madre; the other (No. 1984) represents a modification of the "red mesa" lands that form a more or less continuous terrace along the foot of the range on both sides of the valley. The third kind, not here under discussion, is the alluvial sandy loam of the Santa Ana River.

Regarding the soil first mentioned, it is true, all the way from the head of the valley clear to the Los Angeles River, that it is apt to be too open to resist drought or to retain fertilizers well; in some cases this

*The hydraulic value of a sediment is the velocity in millimeters per second by which it is borne up in a current of water.

† Paper read before East Highlands Farmers' Institute.

defect goes so far that, in order to plant trees successfully, these have to be set from eight to twelve inches beneath the surface to prevent the roots from drying out and to enable them to penetrate soon enough to permanent moisture. Nearly one half of the entire soil mass consists, as the table shows, of coarse materials, which supply little or no plant-food; and even the "fine earth" (i. e., containing no grains of larger diameter than one fiftieth of an inch) is rather coarsely sandy and contains very little clay.

Aside from this mechanical defect, our analysis shows the soil to be in its finer portion, of excellent quality so far as its mineral ingredients are concerned.

The red mesa (No. 1984) is hardly a fair representative of its class. It has a strong admixture of the Sierra Madre mesa soil (No. 2126), as is shown by the nature and amount of its coarse materials, which are simply granite débris. These become more and more prominent as we descend into the subsoil, as is shown in No. 1986. Of this red mesa, isolated patches can be seen along the north side of the valley from Redlands via Mentone, Highlands, Pomona, and Azusa to Monrovia. On the south side of the valley it is conspicuously shown from the San Timoteo Cañon to Riverside and beyond to the Auburndale and Chino hills. Evidently this deposit originally covered the entire valley, but most of it has been subsequently removed by washing-away, by the several streams. The Indian mesa, north of Pomona, is an excellent example of these isolated outliers of the old formation. Its general character is best shown on the terrace which runs along the southern border of the valley between Redlands and Riverside. We have there from 7 to 20 feet of this red soil and subsoil, underlaid by sandy and gravelly layers down to the level of the valley. At Redlands the soils on the slope from Smiley's Park down to the town, exhibit these changes characteristically, but they are best seen in San Timoteo Cañon itself. The soils of East Riverside, below the Gage canal, show characteristically the nature of the land derived from the red terrace formation alone, with but very little admixture of granite débris. The soils of Riverside City are more of a mixture of red and the granite soil, most characteristically shown on the lands of Arlington Heights. Wherever this admixture of granite material is inconsiderable, the red soil is a clay loam, sometimes of considerable tenacity; and while containing a fair supply of potash everywhere, it is rather deficient in phosphoric acid. While it is true that the granite of the Riverside region differs somewhat in composition from that of the Sierra Madre proper, it may still be said that, substantially, the red mesa soil of Highlands corresponds in its origin to the lighter soils of Riverside.

No. 2126. *Gravelly soil* of the southern slope of the Sierra Madre and San Bernardino mountain ranges. These soils are formed from the detritus of these mountains, are quite free from clay and therefore leachy in character. They constitute probably one half of the area not planted in citrus trees in Southern California. Taken to a depth of two feet.

Nos. 1984, 1985, 1986. *Red soil, subsoil, and under-subsoil,* respectively, of the southern foothill region. The soil was taken to a depth of twelve inches. The subsoil is usually a hardpan, varying in thickness, but about four inches in this spot. It was formerly supposed to be a barrier

to the penetration of tree roots, but citrus trees do well upon soils where the hardpan comes to within a foot of the surface. No. 1986, sandy and gravelly loam underlying the hardpan, is of great depth. Sample was taken from sixteen to forty-eight inches below the surface.

The analyses of the above soils were made by Frank J. Snow and R. K. Bishop, students in the Agricultural Laboratory.

Soils and Subsoils from East Highlands, San Bernardino County.

	Gravelly Soil. No. 2126.	Red Soil. No. 1984.	Hardpan Subsoil. No. 1985.	Under Subsoil. No. 1986.
Coarse material	47.60	30.75	28.50	36.90
Fine earth ($\frac{1}{50}$ inch diameter)	52.40	69.25	71.50	63.10
Total	100.00	100.00	100.00	100.00
Analysis of Fine Earth.				
Insoluble matter	65.87 } 78.09	70.32 } 81.59	65.64 } 80.55	63.74 } 79.28
Soluble silica	12.22	11.27	14.91	15.54
Potash	.93	.98	1.15	1.06
Soda	.22	.20	.20	.21
Lime	1.01	.96	1.01	1.42
Magnesia	1.62	1.42	1.50	1.22
Br. ox. of manganese	.10	.06	.04	.04
Peroxid of iron	7.62	6.09	5.76	6.11
Alumina	6.59	5.54	6.73	7.84
Phosphoric acid	.11	.13	.11	.12
Sulfuric acid	.06	.05	.06	.05
Carbonic acid	----	--		--
Water and organic matter	3.35	2.54	2.54	1.87
Total	99.70	99.56	99.65	99.22
Total nitrogen	.140	.150	.12	---
Humus	.620	.580	.98	---
Humus ash	.450	.450	1.03	---
Nitrogen in humus	11.75	10.50	10.41	---
Nitrogen in soil	.073	.061	.102	---
Phosphoric acid, sol. in 2% citric acid	.032	.03	.02	.032
Hygroscopic moisture (absorbed at 16°C.)	----	----	5.29	5.04

The gravelly soil is very high in potash (nearly one per cent), with a full supply of lime, and (for California) a good one of phosphoric acid. The supply of nitrogen, while not very large, is fair, and unless it is desired to specially push the wood-growth of the trees, the figure shown in the nitrogen-percentage of the humus indicates that there is no present need of fertilizers supplying nitrogen.

If, however, it should be desired to stimulate tree-growth beyond the rate natural to the soil, the indication is that in this, as in the case of other lands derived from the Sierra Madre granites, phosphoric acid and nitrogen should be supplied first, or chiefly, the potash-content of the soil being very large. The expediency of such extra stimulation is very often questionable, for the early use of fertilizers naturally tends to restrict the spread and penetration of the roots, and renders the trees much more dependent upon frequent irrigation and fertilization.

But when fertilizers are used, it is in this case doubly important to

take into consideration the very pervious and leachy nature of the land. For supplying phosphoric acid, phosphate slag would be preferable to superphosphate, and, to supply nitrogen, Chile saltpeter should not be used at all, as either rain or irrigation would speedily wash it out of the reach of the tree roots. Even ammonia sulfate is not reliable in this case; the nitrogenous material should either be tankage, or still better, the nitrogen should be supplied by green-manuring with legumes, such as clovers, vetches, or lupins. In the latter case, the soil would be doubly benefited by having its leachiness measurably corrected by the addition of the humus-substance. In fact, the excessive perviousness of this granite land being its chief fault, green-manuring should be resorted to in any case as soon as practicable.

If mixed fertilizers are bought, it should be distinctly understood in which forms phosphoric acid and nitrogen are present. The term "ammonia," as used by fertilizer manufacturers, covers any substance whatever containing nitrogen, from Chile saltpeter to horn shavings and plastering-hair. The fertilizer manufacturer should distinctly state, and guarantee to the purchaser, in which form nitrogen is present, and the delusive term "ammonia" should be abandoned once for all; for in cases like this soil, the difference in the actual value may easily be 50 or 60 per cent of the price paid.

Now, it is well known that the true granites always carry, together with an abundance of potash, a not inconsiderable amount of phosphoric acid; and this is exemplified in the red mesa soil of Highlands, whose phosphoric acid content is considerably above that of the average red lands of Riverside. This richness in phosphoric acid holds equally in the case of the hardpan and the subsoil (1985 and 1986), the latter being mostly of considerable depth, and therefore offering a wide range of mineral nourishment for the trees. The hardpan, so called, offers no serious obstacle to root-penetration, and it therefore seems hardly necessary to break it for that purpose. In view of the fact that in certain light and pervious soils, such a hardpan is the saving clause to prevent injurious leachiness and openness, the question arises whether or not, in this case, the breaking up of the hardpan would be injurious, since it does retard, to some extent, the penetration of the roots. The answer to this question must of necessity depend upon the nature of the subsoil beneath the hardpan. In the present case, the relatively high moisture absorption, shown by the figure 5, and the clayeyness, proved by the hand test of the soil with water, go to show that no bad results need be feared from the breaking up of the hardpan, in case it should approach the surface within easy reach of the plow. When of very considerable thickness it might be blasted by means of dynamite, if desired, where trees are to be planted. The greater clayeyness of the soil, as indicated by the increasing percentage of alumina as we descend, renders this procedure perfectly safe, unless layers of loose sand or gravel should be encountered within a short distance from the surface.

The red land is therefore of a very substantial nature in this region, and until it shall have borne crops for some length of time, there appears to be no special need of fertilization with either phosphoric acid or potash. The supply of nitrogen being about the same as in the granite soil, so far as our investigation has gone, and therefore quite fair, it need not be supplied to fresh lands, but it, with phosphoric acid, will probably be the first needed in the course of cultivation. The red land is

sufficiently retentive to permit the use of Chile saltpeter; but here also, green-manuring with legumes is to be strongly recommended, to increase both the supply of nitrogen and of humus.

While thus the supplying of nitrogen through green-manuring appears to be in both of these soils the measure most likely to be soon needed, it must be remembered that the red soil permits of the use of other fertilizers not applicable to the granite soil. Either stable or sheep manure or compost, which in the case of the granite soil could not be buried deep enough to decay and become available, would be very useful and effective. It is not impossible that the neutral peat of the celery fields of Orange County might also be successfully used in increasing the retentiveness of the granite soil, although sour peat should be strictly avoided. In view of the easy accessibility of Highlands to this source of a possible land-improver, trials of the effects of this peat would be highly desirable. A test with a slip of blue litmus paper will readily serve to distinguish the two kinds of peat from each other; the paper will quickly be reddened if the peat should be of a sour nature.

ENDURANCE OF DROUGHT IN SOILS OF THE ARID REGION.*

By E. W. Hilgard and R. H. Loughridge.

The exceptionally dry season of 1897–8, coupled with the early cessation of rains in the spring of 1897, have brought about, in California, a more extended failure of cereals and pasturage, and shallow-rooted crops generally, than in any year since the State became a prominently agricultural one; the season of 1876–7 being the nearest to carry with it a similar deficiency in crop production. It has been the effort of the California Experiment Station to utilize the past unusual season for the study of the limits of endurance of drought on the part of the several crop plants, and with it to determine the minimum of water that will suffice for their satisfactory growth in the several soils. This work (involving many hundreds of determinations of moisture in soils) is, of course, far from completed, but has already yielded some important results which may serve to provide against a recurrence of avoidable injury in the future.

Amount of Water Required by Crops.—It is not very generally understood how large an amount of water is required for the production even of fair crops; for the maximum of possible product is rarely obtained on the large scale, because it is not often that *all* conditions are at their best at any one time and locality. But from numerous observations, made both in Europe and in the eastern United States, it has been found that from three hundred to over five hundred tons of water are, on the average, required to produce one ton of dry vegetable matter. In Wisconsin, King found that a two-ton crop of oat hay required over one thousand tons of water per acre, equal to about nine inches of rainfall. The average rate for field crops at large is given by European

* Partially published as Bulletin No. 121.

CHEMICAL ANALYSES OF SOILS AND SUBSOILS OF CALIFORNIA, 1897-1898.

Museum Number	Soil Title.	Locality.	County.	Insoluble Residue.			Potash	Soda	Lime	Magnesia	Br. Ox. of Manganese	Ferric Oxid	Alumina	Phosphoric Acid	Sulfuric Acid	Water and Organic Matter	Total	Humus and Nitrogen.					Hygroscopic Moisture	Museum Number	Analyst
				Insoluble Residue	Silica Soluble in Carbonate of Soda	Total												Humus in Soil	Ash of Humus	Nitrogen in Humus	Nitrogen in Soil	Phosphoric Acid			
		Sacramento Valley.																							
1963	Dark valley soil	Near Willows	Glenn	38.00	25.43	63.43	1.06	.30	1.26	2.47	.12	10.48	12.35	.17	.07	8.69	100.40	3.61	----	6.05	.22	.03	11.66	1963	E. R. Lyman.
2195	Tule soil	Near Colusa	Colusa	58.51	16.11	74.62	.49	.12	1.50	1.72	.05	6.55	9.17	.08	.04	5.35	99.69	2.07	----	----	----	.01	7.47	2195	E. R. Lyman.
		Coast Range Region.																							
2187	Sandy loam	Fort Romie, west of Soledad	Monterey	68.50	8.94	77.44	.92	.62	1.22	1.93	.26	6.07	6.56	.11	.31	4.93	100.37	.97	----	11.10	.11	.07	3.78	2187	F. N. Smalley.
1958	Sandy mesa soil	Nipomo	San Luis Obispo	90.95	3.22	94.17	.13	.16	.07	.18	----	1.92	1.81	.03	.03	1.76	100.26	.85	....	14.45	----	.01	1.24	1958	E. R. Lyman.
2080	Valley soil	Four miles west of Santa Maria	Santa Barbara	82.03	3.52	85.55	.55	.22	.34	.76	.02	6.45	1.11	.16	.08	4.65	99.89	1.64	.64	5.36	.09	.03	3.33	2080	F. J. Snow.
		Southern California.																							
2126	Gravelly soil	East Highlands	San Bernardino	65.87	12.22	78.09	.93	.22	1.01	1.62	.10	7.62	6.59	.11	.06	3.35	99.70	.62	.45	11.75	.07	.03	----	2126	R. K. Bishop.
1984	Red soil	East Highlands	San Bernardino	70.32	11.27	81.59	.98	.20	.96	1.42	.06	6.09	5.54	.13	.05	2.54	99.56	.58	.45	10.50	.06	.03	----	1984	R. K. Bishop.
1985	Hardpan subsoil	East Highlands	San Bernardino	65.64	14.91	80.55	1.15	.20	1.01	1.50	.04	5.76	6.73	.11	.06	2.54	99.54	.98	1.03	10.41	.10	.02	5.29	1985	F. J. Snow.
1986	Under-subsoil	East Highlands	San Bernardino	63.74	15.54	79.28	1.06	.21	1.42	1.22	.04	6.11	7.84	.12	.05	1.87	99.22	----	----	----	----	----	5.04	1986	F. J. Snow.

observers at three hundred and twenty-five times the weight of dry matter produced, being at the rate of about three inches of rainfall actually evaporated through the plant.

These data should enable us to estimate the adequacy of the moisture contained in the soil at the beginning of the dry season, to mature the crop; provided we make due allowance for any growth already made at the time, and provided also that the estimates as to the water-requirements derived from the experience of the countries of summer rains (the humid regions) hold good for the arid region also. Whether or not this can be assumed, is among the points our experiments are designed to determine. The surprisingly successful growth and bearing especially of deciduous trees, without irrigation, despite a drought of five or six *months* in the "Franciscan climate,"* has led to an impression that a less amount of water may suffice under arid conditions. For in the East, as many *weeks* of drought and intense heat would frequently suffice to destroy the crop.

PROBABLE CAUSES OF THIS ENDURANCE OF DROUGHT.

Deep Rooting.—Doubtless the main cause of this remarkable endurance is to be found in the *much deeper rooting of all plants in arid climates;* whereby not only a much larger bulk of moist soil is at their command, but the roots are withdrawn from the injurious effects of the hot, dry surface and air.

This deeper range of the roots is not the result of foresight on the part of the plant. It could not occur on Eastern soils, because of the intervention, in the great majority of cases, of difficultly penetrable subsoils; from which, moreover, plants could draw but little nourishment on account of their "rawness." In the arid region, as a rule, subsoils in the Eastern sense do not exist; the soil-mass is practically the same for several feet, and in the prevalent soils is very readily penetrable to great depths. This, summarily speaking, is due to the slight formation of clay, and the rarity of heavy rains, in the arid region. And this easy penetrability of the soil implies, moreover, that being well aërated, the depths of the soil are not "raw," as in the East; and therefore that the "subsoil," such as it is, may fearlessly be turned up as deeply as the farmer is willing to go with the plow, without danger of injuring the next season's crop, in all lands that are well drained; as, by reason of their depth and perviousness, is the case with most California soils. The accompanying photograph (plate 1) taken at Niles, Alameda County, illustrates from nature the deep penetration of a peach root developing in a normally deep, well-aërated "bench" soil, in a manner quite impossible to the same root when growing in land underlaid, as are most Eastern ones, by a subsoil which either is too dense or too wet to be penetrated and utilized by the tree. But beyond this, we have the well-authenticated testimony of intelligent fruit-growers to the effect that in digging wells in the sandy or silty "low mesa" lands, they have found the unmistakable roots of their cherry and prune trees at depths respectively of twenty-one and twenty-four feet. It thus ceases to be a wonder that the decidu-

*This name has been felicitously applied by Powell to the climate of middle and southern California, which is characterized by the concentration of rains within a winter which is mild enough to constitute a growing season, while the summer is practically rainless.

ous fruits of the East can at so many points in California be grown without irrigation through the long summer's drought. The deep-

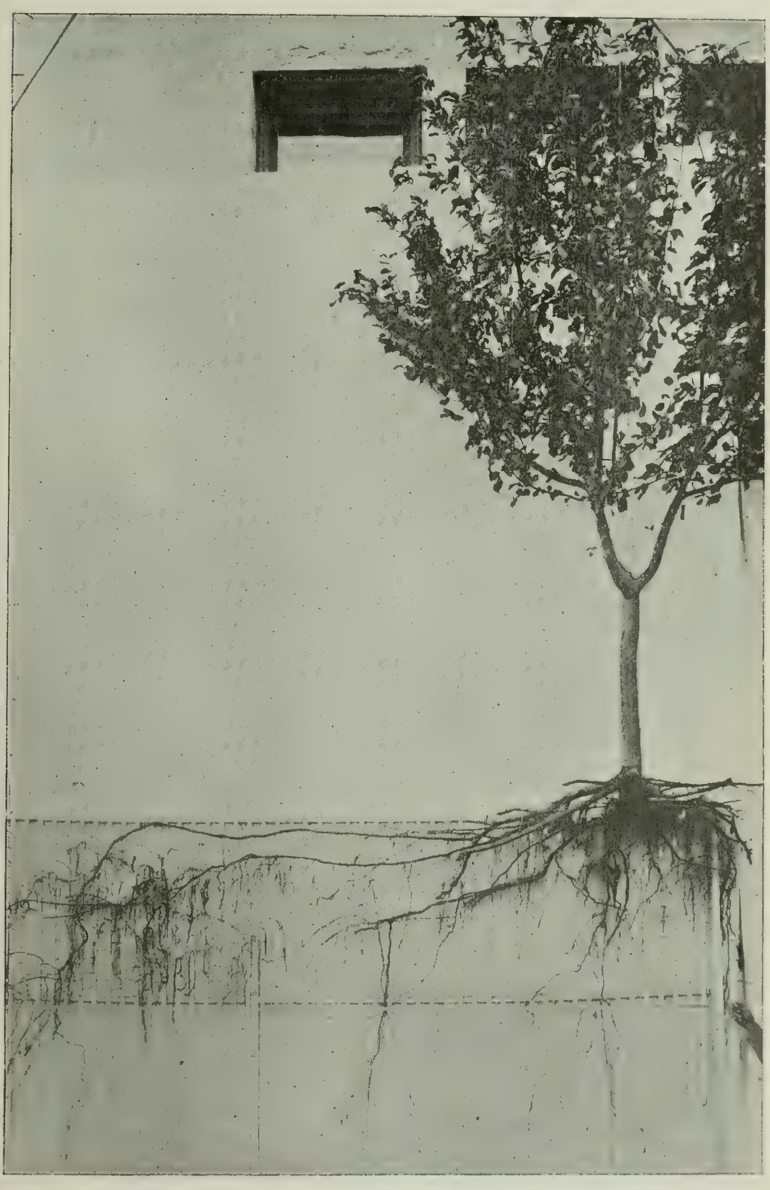


PLATE 2. ROOT OF AN EASTERN (WISCONSIN) FRUIT TREE.
(Photograph by Prof. F. H. King.)

rooting of an orange tree at the Southern California substation (plate 7) and of an almond tree in Yolo County (plate 14) are shown on pages 53 and 79.

A glance at the figures annexed suffices to show that while a root-system like plate 2, a typical Eastern tree root (from a photograph by Prof. King of the University of Wisconsin) will stand in absolute need of frequent rains or irrigation to sustain its vitality, such a one as plate 1 may brave prolonged drought with impunity, be independent of surface conditions, and able to perform all its functions out of reach of stress from lack of moisture.* It is equally clear that it is to the farmer's interest to favor, to the utmost, this deep penetration of the roots, both in the preparation and tillage of the ground, and in the use of irrigation water. For if the latter is used too frequently or too abundantly, the salutary habit of deep-rooting will be abandoned by the plant, and it will, as in the East, be dependent upon frequent rain or irrigation; and also, owing to the small bulk of soil upon which it can draw for its nourishment, upon frequent and abundant fertilization.

Eastern emigrants as well as a large proportion of California farmers do not realize the privilege they possess of having a triple and quadruple acreage of arable soil under their feet, over and above the area for which their title-deeds call; and they tenaciously continue to adhere to precautions and practices which, however salutary and necessary in the region of summer rains, do not apply to this climate.

Shallow Plowing; Plowsole.—The shallow plowing so persistently practiced results in the formation of a "plowsole" that plays the part of the Eastern subsoil in preventing root penetration; limiting their range for moisture and plant-food, and thus naturally causing crops to succumb to a slight stress of season which ought to have passed without injury, had the natural conditions been taken into proper consideration.

That the formation of this plowsole is more apt to occur in some lands than in others, is a fact familiar to all. It should be specially remembered that while clay loams and clays ("adobe") are most quickly injured in that way, especially when plowed too wet, yet continuous plowing to the same depth, year after year, will in the end produce the same result in all but the most purely sandy lands. A close watch should be kept upon this point by every one, and the subsoiler or coulter run with or after the turning plow alternate years, or every three or four years, according to the nature of the land. No doubt many farmers in this State will be able to recall examples of apparently unaccountable failures of the crop of one farmer, while a near neighbor did not suffer; and of fields divided only by a lane or fence, having identical soil and treated alike in all but this respect; in one case, the gang plow year after year to three inches depth, in the other the use of a subsoiler, or heavy chisel cultivator, to five or six inches depth, following the plow annually or biennially.

The *bedrock lands* of Sacramento County, whose clay subsoil must be dynamited to make orchard trees grow thriftily, illustrate very well the condition of things brought about by the formation of a plowsole. Roots will do a great deal to help themselves to the needful moisture, if they are but given a chance. The effect of a naturally existing hardpan upon the development of the root-system of trees is well shown in plate 3, the photograph of a tree at the Southern Coast Range substation near Paso Robles, which after several years' struggle

*The moisture determination under this tree gave, to the depth of 8 feet, 6.6 per cent, or an aggregate amount of water of 1,058 tons per acre.

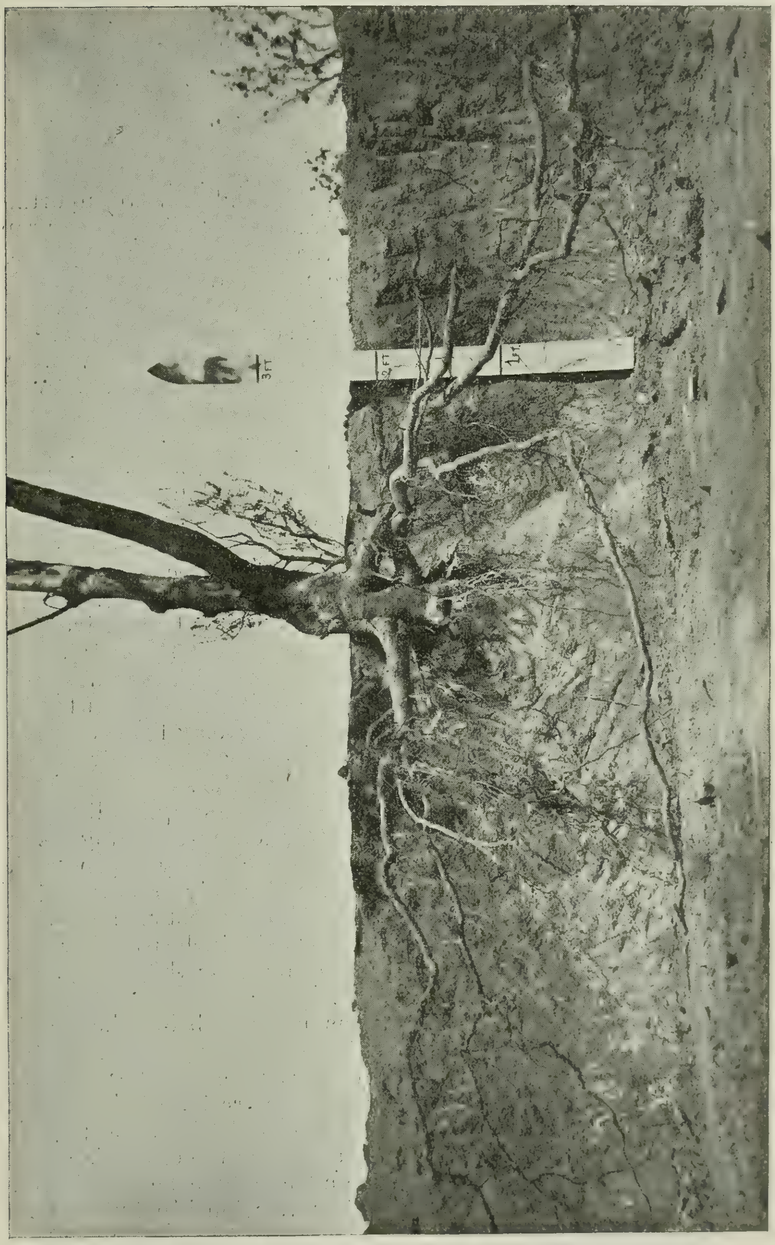


PLATE 3. PEACH TREE ON HARDPAN.—PASO ROBLES SUBSTATION.

for existence finally succumbed during the dry season of 1898. It illustrates tellingly the case of numerous young orchards throughout the State, which having been planted on land underlaid by stiff clay or hardpan, languish or succumb after apparently doing well for three or four years.

The "irrigation hardpan" much discussed of late, is simply a plowsole still more compacted by irrigation.

Penetration of the Roots of Herbaceous Plants.—The subject of deep penetration of roots in arid climates is of such fundamental importance in determining their proper agricultural practice, that it will be proper to give additional illustrations showing that the same rule applies to herbs as well as to trees, and to culture plants derived from humid climates as well. To gain definite data in respect to native herbs, a number of excavations were made under the supervision of Mr. J. Burtt Davy, Assistant Botanist of the Station, with the special object of following down the main roots to their extreme depths of penetration. While it would have been desirable to obtain full photographic views of the root-systems by washing-out, as has usually been done elsewhere, the great depths required, and the difficulty of bringing water to the spots selected, without excessive expense, have compelled us to restrict our actual search to the leading roots only; carefully following and removing them from the soil-mass, so as to make it possible to photograph them outside of the excavation, which would have become excessively costly if so enlarged as to permit of taking the picture *in situ*.

The annexed plate (No. 4) shows the main roots of two native perennial weeds, the California goosefoot (*Chenopodium Californicum*) and the California figwort (*Scrophularia Californica*), both common in the coast ranges. The location was on the lower westward slope of the hills within the University grounds; the soil a heavy clay loam or "black adobe" resulting from the weathering of the clay shale bedrock, fragments of which are abundantly intermixed with the subsoil especially; so that from the eighth foot down, excavation became quite difficult, as the roots had to be followed laboriously in their meanderings among them. The soil-mass was therefore by no means one easy of penetration, as would have been the case in the more usual sandy or powdery soils of the arid region. Yet here we find that the main root of the goosefoot went below the depth of eleven feet (at least six inches farther down, but too fine to be taken out); and judging by their thickness, several other roots went to nearly similar depths.

The main root of the figwort, also, was pursued below the depth of ten feet, where it forked into two thin branches impossible to preserve for photographing, but evidently continuing to several inches additional depth. This proves clearly that the great penetration of the goosefoot was not, as might have been suggested, due to its bulbous root; yet it is true that such thickening of the roots just below the crown is rather a common feature in arid-region plants, and can here be noted even in that of the figwort, within whose botanical relationship bulbous roots are almost unknown.

It was noteworthy that the stem and leaf growth of these two perennial weed plants had been absolutely unaffected by the prevailing drought, being from two to three feet high in both cases, as usual. This was easily understood when it was noted that at the depth of ten feet

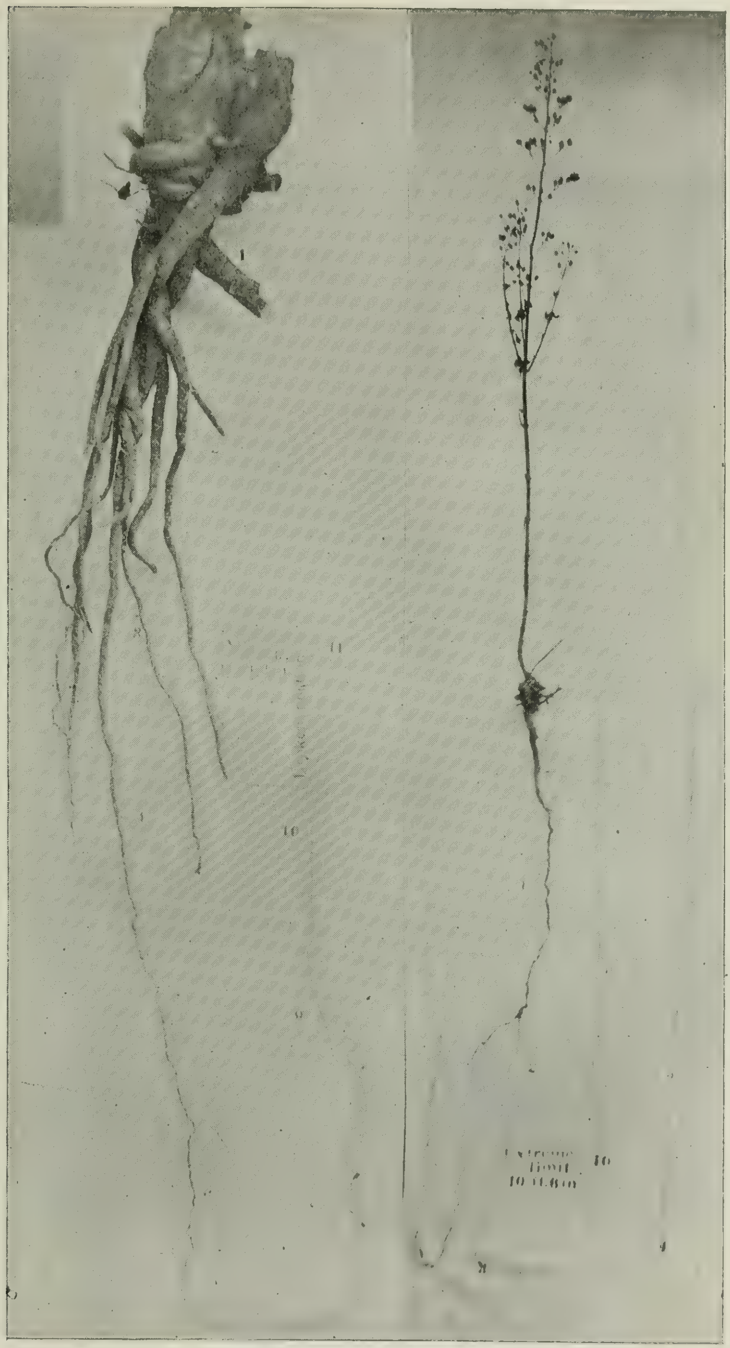


PLATE 4. DEEP-ROOTING OF NATIVE CALIFORNIA GOOSEFOOT AND FIGWORT.

the ground was still so moist from the rains of former years that it was plastic between the fingers; the current year's drought having, after practically sixteen months' absence of rains wetting the ground to more than a few inches depth, penetrated to about four feet only. The percentage of moisture at each foot is given elsewhere in this report.

In an excavation made by Mr. Davy for the root-ends of the California poppy (*Eschscholtzia*) in the seashore sands off San Francisco, it was found that the yellow, rope-like, soft roots remained entirely destitute of nourishing fibrils for several feet, and that while the main roots did not end at five feet, lateral roots terminated in finger-like branches such as are likewise found in certain extremely drought-enduring composites during their bloom. That such fleshy fingers form an absorbent surface less liable to injury from drought than the delicate root-hairs, is obvious.

The Behavior of the Cereal Grasses in this respect being of special interest, an excavation was made alongside of a stalk of corn (plate 5) forming part of a patch which had been planted after the last light shower in May; in order to "bring it up" it was given a slight irrigation at the time of planting, but nothing afterwards. It is a well-known fact that good crops of corn are frequently made in California from corn planted under these conditions, with not a drop of rain after planting; and the plate annexed shows a case in point. It will be noted that the uppermost roots at first developed in the moist ground as they would in the regions of summer rains, only with much more of a vertical tendency. But within a few weeks these clustered roots were surrounded by airdry soil, and could not have supported the plant but for the rapid downward growth of a comparatively limited number of fibrous roots, which supplied the moisture from the depths of the subsoil at five or more feet; while the upper roots, as is also known (from the experiments of Sachs and Henrici), continued to serve nutrition from the airdry soil to a limited extent. A very good crop of well-grown ears was the outcome of this experiment; which is repeated on a farming scale annually throughout the State. It is an excellent illustration of the statement often made by us, that *in the arid region the subsoil is of more importance than the surface soil*, save with very abundant irrigation.

Perhaps the most extreme cases of drought-endurance by plants not natives of the arid region, are exhibited by oats and barley, which are inclined to remain tenaciously as weeds on ground once occupied by these crops. They may then be seen to maintain not only life, but sufficient thriftiness for the formation of healthy though usually small-sized seed, when connected with the ground by a single fine root-fiber; as shown in plate 6, representing an oat plant growing, among many similar ones, in the vineyard nursery on the University grounds, in the heavy black "adobe" land. In this soil it is extremely difficult to follow such fine fibers even with a spray of water, the clods between and within which the roots make their way being apt to break them before softening by the water. They certainly penetrated to the depth of a foot at least, and probably farther, since the soil was airdry almost to that depth, and very hot within the first few surface inches. It will be noted that this plant had no less than five fruiting stems, similar to the ear shown in the photograph. How this single hair-like root could maintain all these in active vegetation, is somewhat difficult to understand from our ordinary experience. It will be noted in the figure that it shows a remarkable development of something like a tuberous root-

crown; this is, however, an aggregate of a number of short fleshy roots, resembling the air-roots of the lower joints of maize; each terminating in a blunt point, from which at the first opportunity of reaching moist ground, pencils of fibrous rootlets begin to develop. But it is not easy

PLATE 5. CORN GROWN WITHOUT RAIN OR IRRIGATION AFTER PLANTING.

to see what other beneficial end they could subserve so long as arid conditions continue.

Precisely the same condition of things has been observed by us in the

PLATE 6. Oat Plant Grown without Rain or Irrigation, after the Last Shower Brought it Up.

case of barley; perhaps even to a more extreme degree, in a soil more heavy and intractable than that of the University grounds, with even more abundant stooling, and the bearing of well-developed and ripened seed. On this account it has taken five or six years to extirpate barley from a well-cultivated vineyard which had last borne a crop of that grain.

On the same land, which in summer is traversed by wide and deep fissures (suncracks) unless kept covered by at least seven inches of well-tilled soil, sweet corn planted after the last rain and when only shallow cultivation was possible, has given a fair crop of ears; some of the plants having their roots bared by the cracking to the depth of ten or twelve inches, but while curling up their leaves during the day continuing to grow and even bear small ears, while connected with the moist subsoil by a single fiber, just as in the case of the oat plant shown in plate 6.

Any one accustomed to the cornfields of the middle West, where in the after-cultivation of corn it is necessary to restrict the depth of tillage very carefully to avoid bringing up a mat of fibrous roots, to the injury of the coming crop, will be impressed by the remarkable adaptability of maize to different climatic conditions, as shown in the above cases. It is perhaps equally surprising that in Southern California especially, in the deep, powdery "low mesa" or bench soils, corn stalks so tall that a man standing on horseback can barely reach the tassel, are quite commonly grown under similar conditions.

As regards the common cereals, the facts above given render it intelligible that a very slight difference in the time of sowing, or in the nature of the subsoil, may readily result in the total failure of one field crop, while its neighbor across the lane, having had time to reach the moist subsoil just ahead of the drought, may yield a normal crop.

Native Annuals.—Mr. Davy also examined the root habit of a number of native annuals; among them that of *Lotus Americanus*, a common wild plant and weed in the coast ranges. The main roots of this legume were found to reach to the depth of over five feet, in a sedimentary soil consisting of three feet of silty soil underlaid by black "adobe," a heavy swamp clay, in which water is found at the depth of about fifteen feet.

A number of introduced weeds, notably the bur clover (*Medicago denticulata*), the tocalote (*Centaurea melitensis*), and the white pigweed (*Amarantus albus*), which are common as "summer weeds," are most tenacious of life under conditions of extreme drought; a single root fiber remaining in connection with the subsoil being sufficient to enable them not only to maintain life, but to bloom and fruit abundantly, so as to thoroughly seed the land for the next season. The indifference with which these small weeds that persist during the dry season, are regarded by farmers who are very particular about keeping their fields clean in spring, results in an enormous weed crop that could easily have been avoided by timely prevention.

Roots Follow Moisture.—Very striking examples of deep rooting, as the result of vertical moisture penetration, can also be observed in some of our native trees, which, while naturally at home on moist ground, are nevertheless sometimes found forming luxuriant clumps on the slopes and even summits of our coast ranges and foothills. If we examine the ground where this occurs in the case of California laurel, we will

generally find that the soil in which they grow is underlaid by slate or shale standing *on edge*, into the crevices of which the roots penetrate, wedging them open; while themselves flattening out, and thus penetrating to moisture at considerable depths. The same may be observed in the case of the erect "bedrock" or foothill slates of the Sierra, on which native as well as fruit trees flourish in very shallow soils, sometimes reaching permanent moisture at the depth of ten or more feet below the surface. It can readily be observed during rains that there is comparatively little run-off from the surface of these lands underlaid by vertical shales.

On the same principle, the grapevines which bear some of the choicest raisins of Malaga on the arid coastward slopes, are made to supply themselves with moisture, without irrigation, by opening around them large, funnel-shaped pits, which remain open in winter so as to catch the rain, causing it to penetrate downward along the tap-root of the vine, in clay shale quite similar to that of the California coast ranges, and like this latter, almost vertically on edge. Yet on these same slopes scarcely any natural vegetation now finds a foothold.

Similarly the "ryots" of parts of India water their crops by applying to each plant immediately around the stem such scanty measure of the precious fluid as they have taken from wells, often of considerable depth, which form their only source of water-supply. Perhaps in imitation of these, an industrious farmer has practiced a similar system on the high benches of Kern River, and has successfully grown excellent fruit for years, on land that originally would grow nothing but cactus. Sub-irrigation from pipes has been applied in a similar manner.

The principle flowing from the above is simply that the most economical mode of using irrigation water is to put it "where it will do the most good," close to the stem of the plant or trunk of the tree, and let it soak downward so as to form a moist path for the roots to follow to the greatest possible depth. It is this deep *penetration to natural moisture*, as a matter of fact, which enables the small quantities supplied to produce such marked effects. This can be observed strikingly in the case of the "summer weeds" that come up after the crop is laid by. Those coming up early will have time to follow the moisture down and survive all summer; while those coming up even two or three days later will just fall short of being able to keep pace with the drying of the soil, and after a short struggle will give up the fight and die out. A very trifling amount of water put in the right place would enable these weeds to reach down and maintain themselves through the season on the natural supply.

Basin Irrigation.—It will be noticed that this principle is practically the same as that of the basin irrigation of orchards, which was originally largely practiced in California, but has now been mostly abandoned for furrow irrigation. The latter has been almost universally adopted, partly because it requires a great deal less hand-labor, partly under the impression that the whole of the soil of the orchard is thus most thoroughly utilized; partly also because of the injurious effect upon trees produced at times by basin irrigation.

The explanation of such injurious effects is, essentially, that cold irrigation water depresses too much the temperature of the earth immediately around the roots, and thus hinders active vegetation to an

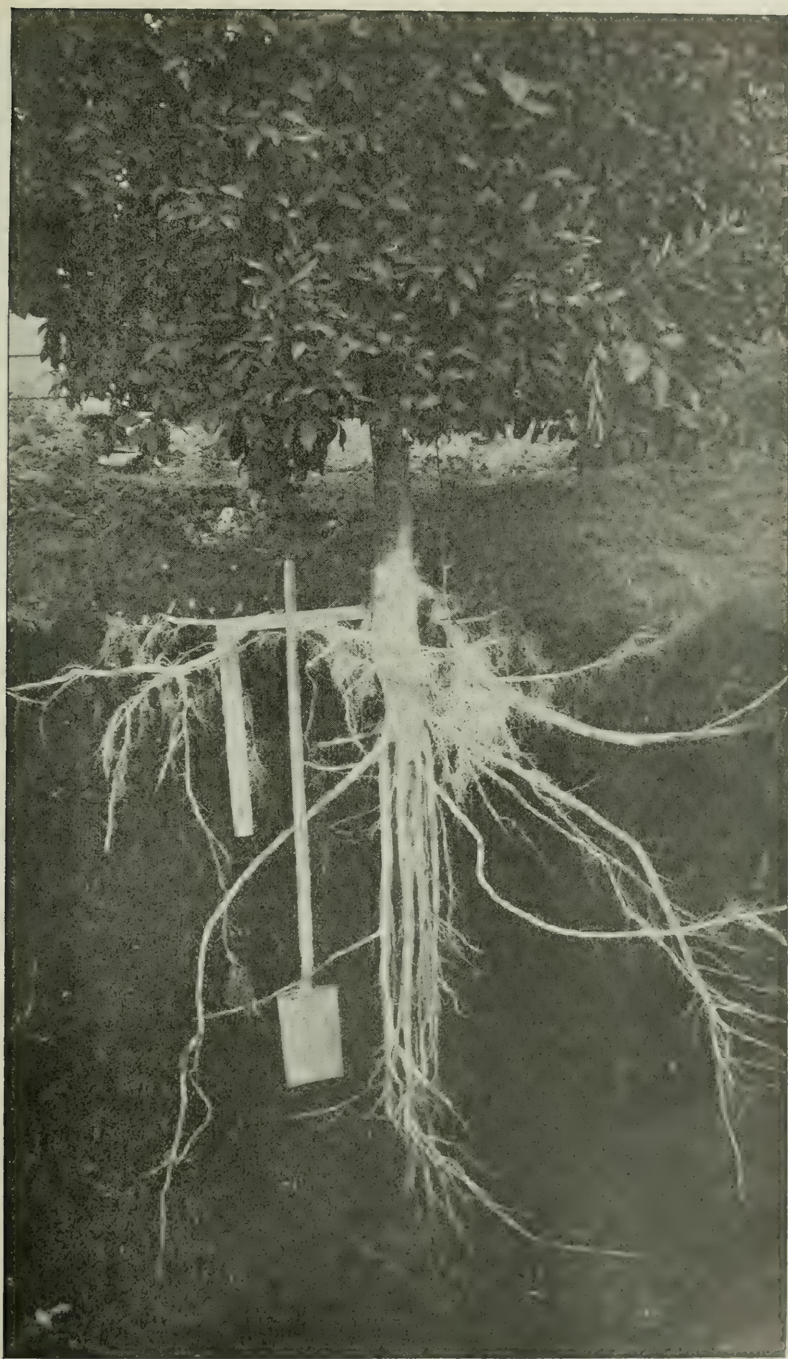


PLATE 7. Orange Tree Showing Root Penetration.

injurious extent, sometimes so as to bring about the dropping of the fruit. This, of course, is a very serious objection, to obviate which it might be necessary to reservoir the water so as to allow it to warm before being applied to the trees. In furrow irrigation the amount of soil soaked with the water is so great that the latter is soon effectually warmed up; besides not coming in contact too intimately with the main roots of the tree, along which the water soaks very readily when applied to the trunk, thus affecting their temperature much more directly. It is for the fruit-grower to determine which consideration should prevail in a given case. If the water-supply be scant and warm, the most effectual use that can be made of it is to apply it immediately around the tree, in a trench dug or plowed for the purpose.* When, on the contrary, irrigation water is abundant and its temperature low, it will be preferable to practice furrow irrigation, or possibly even flooding. As a compromise, the water may be applied in two deep furrows run parallel to the rows at four or five feet distance. The latter practice has brought about the deep-rooting of orange trees at the Southern California substation exemplified in the accompanying plate (No. 7).

To those who are located in or near the foothills and are apt to receive their irrigation water at a temperature not far above that at which it left the high Sierra, this is a very serious consideration. Many a time there have come to the Station complaints of an unaccountable dropping of fruit, or injury to field crops, which, when investigated, were directly traceable to the use of cold irrigation water, at a time when the trees or crops were in full growth. As the same ditch may at different times supply him warm or cold water, according to the use made of it before it reaches the lower level, the irrigator should use, if not a thermometer, at least his hand and a good slice of common sense, to determine whether or not he is running a risk of injury by applying it directly to his land.

As to the more complete use claimed to be made of the soil in flooding and furrow irrigation, it must be remembered that while this is the case in a *horizontal* direction, yet unless irrigation is practiced rather sparingly under the furrow system, it may easily happen that the gain made horizontally is more than offset by a corresponding loss in the *vertical* penetration of the root-system.

This is amply apparent in some of the irrigated orange groves of Southern California, where the fine roots of the trees fill the surface soil as do the roots of maize in a corn field of the Mississippi States; so that the plow can hardly be run without turning them up and under. In these same orchards it will be observed, in digging down, that at the depth of a few feet the soil is too water-soaked to permit of the proper exercise of the root functions, and that the roots existing there are either inactive or diseased. That in such cases abundant irrigation and abundant fertilization alone can maintain an orchard in bearing condition, is a matter of course; and there can be no question that a great deal of the constant cry for the fertilization of orchards in the irrigated sections is due quite as much to the shallowness of

*This is a wholly different matter from the irrational practice of banking up around the tree, by means of the plow, a square basin in which when filled with water the trunk is flooded, and the soil surface compacted so as to result in subsequent rapid evaporation, unless cultivated by hand, as it would usually have to be. The true basin method fills up the ditch with loose earth, which prevents evaporation.

rooting induced by over-irrigation, as to any really necessary exhaustion of the land.

When the roots are induced to come to and remain at the surface, within a surface layer of eighteen to twenty inches, it naturally becomes necessary to feed these roots abundantly, both with moisture and with plant-food. This has naturally led to an over-estimate of the requirements of the trees in both respects. Had deep-rooting been encouraged at first, instead of over-stimulating the growth by surface fertilization and frequent irrigation, some delay in bearing would have been amply compensated for by less of current outlay for fertilizers, and less liability to injury from frequently unavoidable delay, or from inadequacy, of irrigation.

It is curious to note that in the Sacramento Valley, where cultivation antedates considerably that of the regions where, in connection with irrigation, fertilizers are now most abundantly used, we hear so little of the need for fertilization; while from Southern California we constantly receive inquiries as to the fertilizers to be used on lands that are but just being taken into cultivation for the first time; not to speak of lands which after six or eight years' culture are annually dosed with large dressings of expensive fertilizers. Is that because the lands of the Sacramento Valley are more productive, naturally, than those of the sunny south? Not at all; if anything, the lands of the San Gabriel and Santa Ana valleys exceed the Sacramento soils in native supply of plant-food. But while in the latter valley the trees have been allowed to root in accordance with the nature of the climate, without irrigation, orchardists in the south have used all the water they could get from the outset. They have taken their clew from the Eastern conditions of rainfall, and have imitated these as nearly as their supply will permit. However deep and rich their soils, they have shallowed them by over-irrigation; and now both irrigation and fertilization have become as necessary as are the bi-weekly rains and the annual application of fertilizers in the East.

It must not be inferred from the above statement that the Sacramento Valley may expect to do without fertilizers permanently, or even for a long time to come. But it is certain that in the absence of fertilization, these lands have held out wonderfully, simply because the farmers have there availed themselves, it may be unconsciously, of the privileges implied in the conditions of our arid climate.

CONSERVATION OF SOIL MOISTURE.

Alongside of economy in the use of irrigation water, the conservation of the moisture imparted to the soil either by rains or irrigation is most important; critically so where irrigation is unavailable.

Utilization of Winter Rains, and Winter Irrigation.—However strong is the popular demand for storage of the winter rainfall and flood waters, too many do not appreciate the importance of the storage they can command without the use of reservoirs, within their own soil-mass. While there is a well-grounded objection in the humid region to subjecting plowed land to the leaching action of the abundant rains, no such objection holds in the case of lands lying within the limits of twenty or twenty-five inches of annual rainfall. Here the absorption of the winter

rains should be favored to the utmost, for the run-off is mostly a dead loss. *Fall plowing* wherever the land is not naturally adequately absorbent, and is not thereby rendered liable to washing-away, is a very effectual mode of utilizing the winter's moisture to the utmost, so as to bring about the junction of the season's moisture with that of the previous season; which is generally considered as being a condition precedent for crop production in dry years. The same, of course, holds true of *winter irrigation;* the frequent omission of which, in presence of a plentiful water-supply at that season, is a prolific cause of avoidable crop failures. Moistening the ground to a considerable depth by winter irrigation is a very effective mode of promoting deep-rooting, and will thus stand in lieu of later irrigations, which, being usually more scant, tend to keep the roots near the surface.

Knowledge of the Subsoil Important.—It cannot be too strongly insisted upon that in our arid climate farmers should make themselves most thoroughly acquainted with their subsoil down to the depth of at least four, but preferably six or eight feet. This knowledge, important enough in the East, is doubly so here, since all root functions are and must be carried on at much greater depths. It is hardly excusable that a business man calling himself a farmer should omit the most elementary precaution of examining his subsoil before planting orchard or vineyard, and should at the end of five years find his trees a dead loss in consequence of an unsuitable subsoil. Similarly, *no irrigator should be ignorant of the time or amount of water it takes to wet his soil to a certain depth.* We have lately seen a whole community suffering from the visible decline of the thrift of its fruit trees, which occurred despite what was considered abundant irrigation; i. e., allowing the water to run for a given length of time, deemed to be sufficient. Yet on being called on to investigate the causes of the trouble, the Station staff found that the irrigation water had failed to penetrate during the allotted time to any beneficial extent, so that the trees were, in the main, suffering from lack of moisture—a fact that could have been verified by any one of the owners concerned, by simply boring or digging a hole or two. But no one had thought of doing so, and all kinds of mysterious causes were conjectured to be at work in the suffering orchards.

A definite knowledge of the rapidity with which irrigation water penetrates downward and sideways in his soil should form a part of the mental equipment of every irrigator, particularly in arranging his head ditches. For in sandy lands it may easily happen that when these are too far apart, the water near the head ditch is already wasting into the country drainage at the depth of ten or twelve feet, before any has reached the end of the furrows, or has wetted the lower half adequately. Many such cases come under our observation; and such ignorance of the conditions governing one of the most important factors of success is hardly excusable in any one.

Nor is the quality of the water used indifferent in this connection; for waters containing alkali will fail to penetrate the soil as quickly as would ordinary stream waters. Thus we have found by actual trial, that while a creek water would penetrate a certain soil to the depth of thirty inches in twenty-four hours, the alkaline water of a lake, used on the same, would barely reach down to twelve inches in the same space of time.

Percolation of Irrigation Water.—Investigations were made at the Experiment Station near Pomona as to the distribution of irrigation water, soon after application. The water was to supply orange trees. The samples were taken from the bottom of the water furrow and from a distance of four feet from the furrow.

Valley Land.	Bottom of Furrow.		Four Feet from Furrow.	
	Per Cent.	Tons per Acre.	Per Cent.	Tons per Acre.
Micaceous sandy soil	6.1	122	3.3	66
Micaceous sandy soil	4.3	86	3.8	76
Micaceous sandy soil	4.7	94	6.0	120
Micaceous sandy soil	6.5	130	7.8	156
Micaceous sandy soil	7.8	156	7.3	146
Micaceous sandy soil	7.9	158	7.2	144
Totals	6.2	746	5.8	708

The roots of the orange trees were evidently taking their water from the second and third foot; as the amount at that point was very much less than at lower depths. The irrigation given, while supplying the surface soil with water, had evidently failed to soak to the second foot; and in sidewise percolation had reached but a very short distance—for the first and second foot show no more moisture than would be held by absorption from the air.

Preventing Evaporation.—But supposing the moisture to have reached the depths of the soil, whether from rains or from irrigation, it is essential that proper means be employed for retaining it in the land, and especially to prevent evaporation. That this is best accomplished by a mulch on the surface, and that the best mulch for the purpose, which need not be hauled on or off and is always ready, is a surface layer of loose, well-tilled soil, is now pretty well understood by all. But the extent to which the presence or absence of such a non-evaporating layer influences plant growth and fruit production in a critical time, is not so fully appreciated.

Plates 8, 9, and 10 give an illustrative example of trees and fruit grown in 1898 on adjacent fields, with only a lane between, the soil and all natural conditions being absolutely identical; the only difference being the presence and absence of cultivation. In the present case the cultivation was omitted on principle by one owner, who considered cultivation superfluous on the loose, generous soil of Alameda Creek; while his neighbor, across the way, held the opposite belief, and had this season cultivated to an extra depth to conserve moisture. The cultural results are sufficiently shown in the plates and need no comment, although it may be of interest to mention that the year's new growth on the one hand was over three feet, on the other barely three inches, as shown in plate 9. The effect on the fruit is shown in plate 10. The determination of the moisture held by the soil in July to the depth of six feet gave the following results:

Cultivated. Uncultivated.

PLATE 8. APRICOT TREES, CREEK BENCH LAND, AT NILES, CAL.

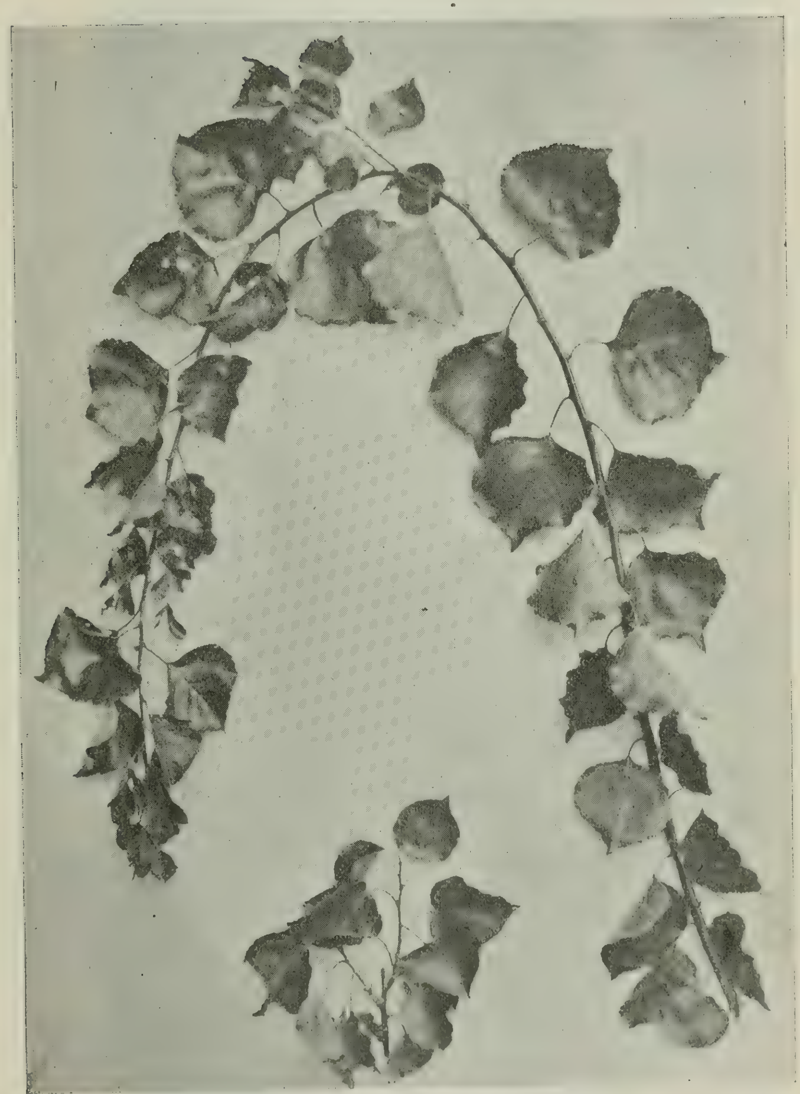
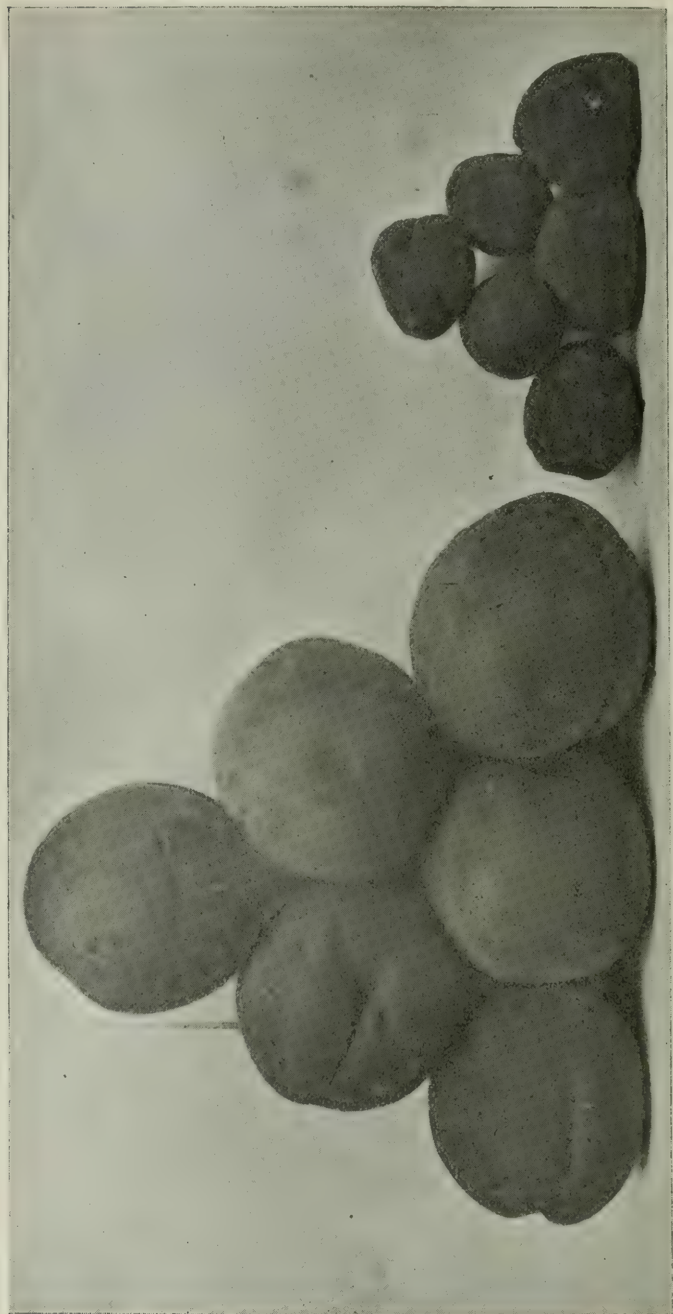


PLATE 9. NEW GROWTH ON TREES, CULTIVATED AND UNCULTIVATED.
CREEK BENCH LAND AT NILES, CAL.



From Cultivated Trees.

From Uncultivated Trees.

PLATE 10. FRUIT FROM APRICOT TREES, NILES, CAL.

Depth in Soil.	Cultivated.		Uncultivated.	
	Per Cent.	Tons per Acre.	Per Cent.	Tons per Acre.
First foot	6.4	128	4.3	86
Second foot	5.8	116	4.4	88
Third foot	6.4	128	3.9	78
Fourth foot	6.5	130	5.1	102
Fifth foot	6.7	134	3.4	68
Sixth foot	6.0	120	4.5	90
Total for six feet	**6.3**	**756**	**4.2**	**512**

The difference of 244 tons per acre of ground shown by the analyses is quite sufficient, according to the data given at the beginning of this article, to account for the observed difference in the cultural result. The cause of this difference was that in the *uncultivated* field there was a compacted surface layer several inches in thickness, which forcibly abstracted the moisture from the substrata and evaporated it from its surface; while the loose surface soil on the *cultivated* ground was unable to take any moisture from the denser subsoil. This is well illustrated by the familiar fact that while a dry brick will suck a wet sponge dry, a dry sponge (corresponding to the loose surface soil) is unable to take any water from a wet brick. Besides, the tilled surface soil forms a non-conducting layer protecting the subsoil from the sun's heat and the dryness of the air.

Effect of Cultivation Illustrated.—The above apricot orchard, which in 1898 was in such poor condition because of lack of any cultivation for the two previous years and whose photograph is given above, was in 1899 and 1900 deeply plowed and cultivated. The soil had, however, been so severely injured by neglect that it has not recovered that mellow condition so desirable The result on tree growth and appearance is apparent and is shown in the accompanying photograph (plate 11), taken in August, 1900, the trees being the same.

The season of 1899 and 1900 was a dry one and the rainfall comparatively small. The moisture left in the soil after the season of 1898 was therefore almost the sole dependence of the trees, and was naturally drawn upon heavily by the heavy foliage of the cultivated orchard and but slightly by the other. There would be therefore less water in the former than in the latter, as is shown in the table below:

	Per Cent.	Tons per Acre.
Apricot orchard still under good cultivation	3.9	386
Apricot orchard formerly neglected, now cultivated	4.3	438
Almond orchard under good cultivation	7.6	762
Almond orchard once cultivated, now neglected	5.0	500

In the same valley, and near each other, upon the alluvial land of Alameda Creek, there are two almond orchards, which also illustrate the effect of good care on the one hand and of neglect on the other; in the one the trees are in fine condition, in a mellow soil; in the other they are suffering severely, in a soil hard and compacted. The moisture content of each is given in the table.

Not Cultivated—1898. Cultivated—1899 and 1900.

Cultivation to Various Depths.—In the East, where this principle is well understood, it is considered that a surface layer three inches in thickness is sufficient to afford effective protection. But what is adequate in the region of summer rains is quite insufficient in California and in the arid region generally. It takes fully twice the thickness mentioned, and preferably more, to afford protection against the drought and heat, which last for five or six months at a stretch. Here again we find an important point in which our practice must differ from that of the East and of the Old World.

While pursuing our investigations on the moisture of the soil in various parts of the State, we have been fortunate in securing results which bear directly on the question as to what depth of cultivation is best for conserving the moisture and for preventing to a large extent the excessive waste by evaporation from the surface of the soil. In several localities two or more fields or orchards were found upon soils alluvial in character and having the same physical and chemical characteristics, but which had been treated differently, their cultivation being shallow or deep, no irrigation being given. These localities were the following:

At Niles, in Alameda County, on the alluvial loam of Alameda Creek, there are three apricot orchards under different systems of cultivation. Two of these have already been spoken of, but for general comparison will be again mentioned. One of them had received *no cultivation* for two years; the ground was compact and hard, the trees had lost most of their leaves (as shown in plate 8), and the fruit was very small and sparse; the new growth on the trees was but about three inches long, as shown in plate 9.

On the south and adjoining this was an orchard in which cultivation had been shallow (about three inches), and the leaves on the trees were somewhat wilted during hot days, but recovered during the cooler nights; the fruit was fair in size and quantity.

On the north of the first orchard, and separated by a lane from it, was another, in which deep cultivation had been given to conserve the moisture; the trees were in excellent foliage and loaded with fruit, and the new growth was about three feet in length.

Samples of soil from the three orchards were taken on the same day in July, for comparison as to their moisture content. The results are given in the table below.

The cultural results in the first and third are sufficiently shown in the photographs (plates 8 and 9), and need no comment; the effect on the fruit is also shown in plate 10.

Two fields on the river alluvial loam near the sugar factory at Santa Maria, Santa Barbara County, are but a short distance apart; the one having had but a shallow cultivation and bearing no crop, the other cultivated deeper and supporting a small growth of beans. Both series of samples were taken in September.

Two orchards upon the silty soils of the Saticoy Plain, three miles east of Ventura, are but a short distance from each other. One of these had received but shallow, the other a deep, cultivation. Samples were taken in September.

SOIL MOISTURE AFTER SHALLOW AND DEEP CULTIVATION.

Depth.	Alameda County, Niles. Alluvial of Alameda Creek.						Santa Barbara Co., near Santa Maria. Alluvial of Santa Maria River.				Ventura Co., East of Ventura. Silty Soil of Saticoy Plain.			
	None.		3 Inches.		6 Inches.		3 Inches.		6 Inches.		Shallow.		Deep.	
	Per Cent.	T'ns per Acre.	Per Cent.	T'ns per Acre.	Per Cent.	T'ns per Acre.	Per Cent.	T'ns per Acre.	Per Cent.	T'ns per Acre.	Per Cent.	T'ns per Acre.	Per Cent.	T'ns per Acre.
First foot	4.3	86	5.5	110	6.4	128	4.6	92	6.2	124	9.5	190	8.4	168
Second foot	4.4	88	5.9	118	5.8	118	6.1	122	7.1	142	9.7	194	10.1	202
Third foot	3.9	78	5.5	110	6.4	128	5.1	102	7.8	156	6.7	134	9.4	188
Fourth foot	5.1	102	4.6	92	6.5	130	5.3	106	12.0	240	7.3	146	9.3	186
In 4 feet	4.4	354	5.4	430	6.3	504	5.3	422	8.5	662	8.3	664	9.3	744
Fifth foot	3.4	68	-----	-----	6.7	134								
Sixth foot	4.5	90	-----	-----	6.0	120								
In 6 feet	4.2	512	----	-----	6.3	756								

The beneficial effects produced by a cultivation or loosening of the soil to a depth of six inches above that of three inches is quite marked in the three widely separated localities represented in the above results. At Niles the difference of 70 tons per acre in four feet of soil seems to have prevented wilting of the leaves. In the sandy alluvium soil of Santa Maria Valley there was a saving of 240 tons per acre; and in the silt of Saticoy Plain, a difference of 80 tons of moisture per acre in four feet depth. This means much for our California orchard soils, where the main feeding rootlets are at a depth of many feet. In grain land the three inches would be preferable, for otherwise the soil would become too dry in the upper foot, where germination of the seed occurs and the roots secure food and moisture.

Summer-Fallow.—The beneficial effects of summer-fallow in California are assuredly due quite as much to the conservation of moisture brought about by the tilled surface layer, as by the weathering of the soil to which the efficacy of the fallow is commonly ascribed. Witness the fact that weeds come up freely on summer-fallow as late as August, when unplowed land is as bare as a barn floor.

Injury from Weeds.—Similarly, on our mostly new and unexhausted lands the bad effects of weed growth are doubtless due fully as much to the waste of moisture going on through their leaves as to the competition with the crop in plant-food. Hence all good orchardists are very careful about keeping their ground clean in summer; but it must not be forgotten that by doing so they quickly deplete their lands of vegetable matter, which requires systematic replacement by green-manuring if production is to continue normally. Yet of the two evils, the loss of moisture is more to be dreaded, and very generally in practice the more difficult to remedy.

MOISTURE IN CALIFORNIA SOILS DURING THE DRY SEASON OF 1898.

By R. H. Loughridge.

The rainy season in California occurs during the winter and early spring months, and after the first of May but little precipitation is anticipated. During this season, therefore, the amount of rainfall must be sufficient to supply the demands of vegetation of all kinds, and that amount must, as far as possible, be received by the soil and carefully stored up in its lower depths; otherwise our crops will be dependent upon moisture drawn up by capillarity from the ground-water or upon an artificial irrigation supply. The demand, of course, varies with each crop, and in round numbers is from 325 to 520 times the weight of dry matter produced, as stated elsewhere. Thus for each ton of barley hay 393 tons of water is used during its growth, of wheat hay 500 tons, and of oat hay 522 tons. These amounts however do not represent what should be in the soil during the plant growth, for losses occur from surface evaporation, and from percolation and other causes; then, too, the roots of the plant do not occupy all of the space in the soil. The rainfall should therefore be from 16 to 20 inches during the season to supply all demands, and should be properly conserved against losses.

The difference in amount of rainfall between the season of 1896–7 and 1897–8 was very great, as is shown in the data kindly furnished by the Weather Service in San Francisco, and by the records kept at the several culture substations in the State:

	1896–7.	1897–8.	Difference.
San Francisco	23.43	9.38	14.05
Sacramento	17.02	10.50	6.52
Santa Maria	15.14	5.69	9.45
Ventura	15.89	6.44	9.45
Los Angeles	16.72	7.06	9.66
For Culture Substations:			
Paso Robles, San Luis Obispo County	17.94	4.75	13.19
Tulare, Tulare County	----	----	---
Jackson, Amador County	42.98	19.15	23.83
Pomona, Los Angeles County	17.80	9.39	8.41
For the State at large	32.31	10.08	22.23

The crops of 1897 clearly withdrew the greater part of the water that had fallen the previous season, and but little was left as a reserve to supplement the precipitation of the following season, which was extremely low. The supply in 1898 was therefore soon largely exhausted by the crops and by surface evaporation from the soil, leaving but little more than the hygroscopic moisture, or that naturally absorbed from the air and held by the soil for itself, and from which the trees and other deep-rooted crops could barely draw enough to maintain life, making them dependent upon either the ground-water or irrigation for growth and fruiting. Shallow-rooted crops, and even trees whose feeding

roots had been allowed to remain near the surface, suffered and in many cases died.

This *hygroscopic moisture*, which is found in all soils and at all times, varies in its amounts according to the texture of the soil; thus in sandy soils there is usually from 2 to 3 per cent present, in loams from 4 to 5 per cent, and in heavy clays and adobes from 8 to 10 per cent. The soils hold most of this moisture against all efforts of the plant to withdraw it, and a greater force than that exerted by plant roots or by solar heat is necessary to free the soils from it. With this moisture plants may, in many instances, be able to barely live, but for growth and vigor they are dependent upon the "free water" of the soil. This is strongly shown in the tables at the last of this article.

In the following pages the *hygroscopic moisture* and the *free water* of the soil is frequently spoken of, the latter being that contained over and above what is held in the hygroscopic condition, and representing that which is considered as free to enter the plant roots, and upon which the plant chiefly depends.

Localities from which Samples were Obtained.—In the examination made for moisture conditions in 1898, samples of soils were obtained from fifteen counties, representing some of the chief cultural regions of the State. Circumstances were such that we were unable to visit such prominent and important regions as the valley of Sonoma, the Auburn foothills, etc., but the results as obtained show very well the general conditions that then prevailed throughout the State. In each case a sample of each foot to the depth of several feet was taken, and its moisture content ascertained; but in the tables accompanying this report, only the general average of the four feet is given, lack of space preventing a presentation of full results.

RECORD OF MOISTURE DETERMINATIONS.

Uncultivated Lands.

Alameda County.—A very heavy black adobe occurs in West Berkeley away from the bay shore, and at the time of taking samples (July) was bare of vegetation and much traversed with sun-cracks.

Amador County.—Samples of soil from the granitic and reddish-clay slate lands of the Experiment Station that had received no cultivation, were taken for comparison with similar lands well cultivated and growing orchard trees.

Tulare County.—Level saltgrass land near Elk Bayou, east of Tulare. The soil is a micaceous loam, very dry, and difficult to remove from the hole with the auger. At three feet it was somewhat moist. It was covered with a good growth of saltgrass.

Monterey County.—Fort Romie colony lands, west of Soledad. These lands are sandy and deep. No vegetation at this point.

San Luis Obispo County.—Samples of the mesa lands of the Experiment Station near Paso Robles were taken from a tract that had been uncultivated for a year. The grass on this had dried up. The samples were taken on August 1st and on October 15th, to ascertain the loss by evaporation from the surface of the soil during these seventy-five days of summer heat.

High mesa lands reach south from Arroyo Grande to the Santa Maria River, beyond Nipomo, and it was a short distance (one-fourth mile) from the bluffs bordering the river that samples were taken for moisture determinations. The land is sandy, and at three feet was underlaid by a hardpan so firmly cemented that the auger would not penetrate it.

Santa Barbara County.—Near the sugar factory west of Santa Maria, samples of soil were taken of the valley loam from two localities. On one tract the soil had been stirred to three inches depth, on the other six inches.

Alkali Lands.

Samples of soil were taken from the Experiment Station near Tulare to ascertain the respective moisture content in alkali of the blackest character (just outside of the tract) and in that adjoining which had once been of similar black character, but now reclaimed by the application of gypsum. The surface of the former was perfectly bare of vegetation, and covered with black alkali crust, while on the other wheat had grown irregularly from six to twelve inches high, through a crust of white alkali. Samples were taken on May 26th. Another sample series of reclaimed alkali was taken from plot 16 on September 20th.

For comparison with the above the results of moisture determination of the white alkali soil from Corona and of another from the same place, in which very little alkali was found, are given:

Moisture in Uncultivated Lands.

Nature of Soil.	Locality.	County.	Date When Taken	Moisture in Four Feet. Percentage. Total Found	Hygroscopic	Free	Tons per Acre Free
Adobe	West Berkeley	Alameda		16.9	10.0	6.9	552
Granitic land	Experiment Station	Amador		9.0	5.5	3.5	280
Red slate land	Experiment Station	Amador		6.7	6.3	.4	32
Adobe	Experiment Station	Amador		11.6	10.2	1.4	112
Saltgrass land	East of Tulare	Tulare		3.7	1.5	2.2	176
Sandy plains	Fort Romie	Monterey		4.8	3.2	1.6	128
Sandy mesa	Ex. Sta'n Paso Robles	S. Luis Obispo	Aug.	2.6	1.5	1.1	88
Sandy mesa	Ex. Sta'n Paso Robles	S. Luis Obispo	Oct.	2.5	1.5	1.0	80
Sandy mesa	North of Santa Maria	S. Luis Obispo		1.8	1.4	.4	32
Sandy Loam—Cultivated, but No Crops.							
Cultivated 3 ins.	Santa Maria Valley	Santa Barbara		8.3	2.8	5.5	440
Cultivated 6 ins.	Santa Maria Valley	Santa Barbara		9.3	2.8	6.5	520
Alkali Lands.							
Black alkali	Experiment Station	Tulare		15.8	6.0	9.8	784
Reclaimed alkali	Exp. Station, Plot 6	Tulare		14.9	5.5	9.4	752
Reclaimed alkali	Exp. Station, Plot 16	Tulare		8.5	5.5	3.0	240
White alkali	Corona	Riverside		10.2	3.0	7.2	576
No alkali	Corona	Riverside		6.6	3.0	3.3	264

From the above tables it is seen that the clayey soils, notably the West Berkeley sample, with its 16.9 per cent, have retained a much greater amount of moisture than the more sandy ones, with the exception of that of the moist lands of the ten-acre tract of the Southern California Experiment Station near Chino.

As a rule, too, the amount of moisture is but little more than that naturally absorbed by the soil as hygroscopic moisture, thus showing the almost complete drying-out of the lands where no cultivation had been given.

It was unfortunate that the first samples of the uncultivated mesa land of the Experiment Station near Paso Robles were taken so late in the extremely dry season, when the moisture left over from the last year or received from the scanty rainfall of the winter, had already escaped from the land by evaporation. That there was some loss during the seventy days elapsing between the first and second sampling is shown in the lowering of the percentage in the surface foot (1.3 to 0.8 per cent), and that there was an upward movement by capillarity was seen in the lowering of the percentages in the sixth and seventh foot of that series (3.5 to 3.4 per cent).

In the two Santa Maria Valley specimens the results show the benefits to be derived from a six-inch cultivation of the soil.

Of the Tulare specimens, the black alkali and the white alkali from plot 6 are practically of the same strength in total salts, and are very nearly comparable, for they were originally a part of the same black alkali spot, but now separated by a line of fence and deep ditch and about twenty-five feet from hole to hole. Scarcely any carbonate of soda remains in plot 6, it having been converted to the sulfate by the use of gypsum. The two series of samples have about the same amount of moisture, the difference being only about one per cent, thus indicating about the same retentive power for both black and white alkali in soils. On plot 16 the amount of alkali was less and its effects on water absorption are not so apparent, the soil containing an amount about normal for this soil. In the Corona orchards the difference between an alkali soil and one free from alkali is very apparent, both having been irrigated presumably with the same amounts of water during the season.

MOISTURE IN GRAIN LAND.

WHEAT.

Tulare County.—Wheat had been planted upon an *old alkali spot* (on which nothing would grow previous to reclamation with gypsum) in the Experiment Station tract, and had received one irrigation in early spring. At the time that the samples of soil were taken (May) the grain was about three feet high and well headed.

Samples of the *black clay lands*, three miles west of Tulare substation, were taken on May 24th. The land had been plowed about six inches deep and wheat sown upon it, but after growing a few inches had completely died off.

Samples of the *reddish clay loams* lying along the foothills east of Tulare were taken on May 26th. Grain had been planted on this tract, but had died for want of moisture. At the fourth foot the soil was so dry that it was impossible to draw it to the surface upon the auger.

Stanislaus County.—Samples of the sandy wheat lands of this region were taken on the place of Mr. Vital Bangs, four miles northeast of Modesto. The first of the series was taken in April, from a cultivated field on which the grain was small though green, and which finally died from lack of moisture. Again on May 30th other samples were taken from a field which had been summer-fallowed the previous year, and which had produced a small crop of wheat. Had this been examined in April there would have probably been found more moisture than in the other field. Samples were also taken in May from the tract of land in front of the residence; this land had not been cultivated, and contained more decayed vegetation (humus) than the others.

Napa County.—In the Talcoa vineyard tract the low flats of the creek that flows through the place was given to grain and had produced an excellent crop, which had been harvested. The soil of this flat is a heavy adobe, deep and black and hard to cultivate, and had become sun-cracked from exposure after harvest.

San Joaquin County.—Samples of the adobe lands on the place of Mr. Overhiser were taken in April. Wheat had been sown on this land, but after making a few inches growth had died for lack of moisture. The surface soil was found to contain about 9 per cent and the third foot about 14 per cent of moisture, the average being 11 per cent, or nearly 900 tons per acre to the depth of four feet. This amount about represents that which the soil would naturally absorb from the atmosphere (hygroscopic moisture) and held so closely that plants would not be able to withdraw enough for growth.

Barley.

Alameda County.—The adobe land of the Economic Garden of the University has been kept in excellent condition, and on it there had been grown several varieties of grain, which had reached a height of three or four feet and were well headed. On May 10th the barley showed distress and wilted during the day, though recovering at night; samples of soil to the depth of three feet were therefore taken to ascertain the amount of moisture present.

Los Angeles County.—Barley had been planted for hay on the lower mesa land of the Santa Monica Forestry Station, but had died for want of moisture. In September the samples of the soil were taken.

Corn.

Alameda County.—Corn growing near the barley plot in the Economic Garden of the University, planted after the last rains in the spring, had without irrigation reached a height of about twelve feet, and thrown its roots down some five feet in the hard soil (see photograph, page 49) when the samples of soil were taken on August 29th.

Los Angeles County.—Corn planted on the lower mesa lands of the Santa Monica Forestry Station did fairly well. It had been irrigated several times. Samples were taken in September.

Soil.	Locality.	County.	Condition of Crop	Moisture in Four Feet. Percentage. Total	Hygroscopic	Free	Tons per Acre—Free
	WHEAT.						
Reclaim'd alkali	Experiment Station	Tulare	Good	12.8	5.6	7.2	576
Black land	West of Tulare	Tulare	Dead	14.1	10.5	3.6	288
Red clay loam	East of Tulare	Tulare	Dead	7.9	6.5	1.4	112
Sandy	Four miles north of Modesto, Apr. 3	Stanislaus	Poor	2.6	1.9	.7	56
Sandy	Four miles north of Modesto, May 30	Stanislaus	Poor	1.9	1.9	0	0
Adobe	Talcoa, west of Napa	Napa	After harvest.	13.7	11.7	2.0	160
	CORN.						
Black adobe	Economic Garden, University	Alameda	Very good	12.9	8.8	4.1	328
Mesa sandy soil	Santa Monica	Los Angeles	Fair	6.1	2.3	3.8	304
	BARLEY.						
Black adobe	Economic Garden, University	Alameda	Wilting	10.7	8.8	1.9	152
Sandy mesa	Santa Monica	Los Angeles	Dead	3.3	3.3	0	0

The fact that *wheat* grew well on land with 12.8 per cent of moisture and died on land with 14 per cent is accounted for by the difference in the character of the land; the first being a loose sandy loam, whose hygroscopic power was low and in which the roots of the grain had freedom for penetration, while the other was an adobe, with high hygroscopic power, leaving but little free moisture for the grain, the roots of which not only could not penetrate deeply, but were also doubtless much torn apart by the shrinkage and cracking of the soil.

The red clay soil of the eastern part of the county also had a high hygroscopic power, and but little moisture was left for the use of the grain in the upper foot.

The sandy lands of Stanislaus County had, on the other hand, a very low hygroscopic power, and hence the roots of the grain, with freedom of penetration, were able to secure for a part of the season a fair amount of free moisture in the land not fallowed the previous season; while in the fallowed land there was enough to produce a moderate crop, as shown by the moisture samples taken at the end of the season.

The black clay land of the low-land of the Talcoa vineyard had an abundance of free moisture, with some to spare after the crop had been harvested.

The corn and barley plots in the University Economic Garden were some distance apart, and the amount of free moisture varied considerably. It is evident from the wilting of the barley that a clayey soil should have more than 2 per cent of free moisture for vigorous growth of that crop.

The land of the Economic Garden was clearly supplied with moisture in sufficient amount in the entire three feet depth; but the surface foot contained no free moisture, and the lower two feet failed to send it up to the roots of the grain in the first foot with sufficient rapidity to replace

that drawn up into the stalk and leaves and out into the air. The result was that the cells of the stalks were not completely filled with moisture and they collapsed. The movement of moisture by capillarity in a soil of such fine texture as adobe has been found to be extremely slow, because of the tenacious manner in which it is held.

The gravelly nature of the Santa Monica land was favorable to heat and the consequent drying out of all of its moisture except hygroscopic; while at the same time the presence of so large an amount of gravel and pebbles was unfavorable to the rise of free moisture by capillarity from any source of supply below.

SALTBUSH, HAIRY VETCH, SUGAR BEETS, AND OTHER CULTURES.

Saltbush.

Tulare County.—The saltbush on the Experiment Station tract at Tulare is growing both upon the sandy soils and in an alkali sump where there is a large accumulation of alkali. The moisture samples of the sump were taken September 20th; those of the sandy land later.

San Luis Obispo County.—The saltbush at the Experiment Station at Paso Robles is growing in dry sandy soil, beneath which a compact hardpan exists at three feet. The roots of the plant, however, penetrated six feet into this, as shown by following the rootlets down to that depth. Samples were taken in September. (Plate 12.)

Hairy Vetch.

Alameda County.—In the adobe soil of the Economic Garden of the University a splendid crop of hairy vetch was matured, yielding at the rate of about seventeen tons per acre. While still green on July 19th an examination of the soil in the middle of the plot was made.

Soya Bean.

San Bernardino County.—Samples of the soil of the soya bean plot in the micaceous sandy loam of the Experiment Station were taken in October, when the plant was doing well.

Sugar Beets and Sorghum.

San Bernardino County.—The sugar beets growing on plot 41 of the ten-acre tract of the Experiment Station near Chino, had not attained a large growth on July 18th, when the samples of soil were taken.

On plot 100 of this same tract the sugar beets were in excellent condition, had made a good growth, and were of full size before harvesting.

Ventura County.—The flat, alluvial lands around the beet sugar factory at Oxnard are very generally planted to sugar beets. The soil is a black loam, more or less charged with white alkali (no carbonate of soda), and the beets grow well, reaching a high sugar percentage and purity coefficient. Samples of the soil were taken on September 11th. The fourth foot was almost a mud.

Santa Cruz County.—The dark loam land in the region of Pajaro Station had, on August 14th, a fair crop of sugar beets.

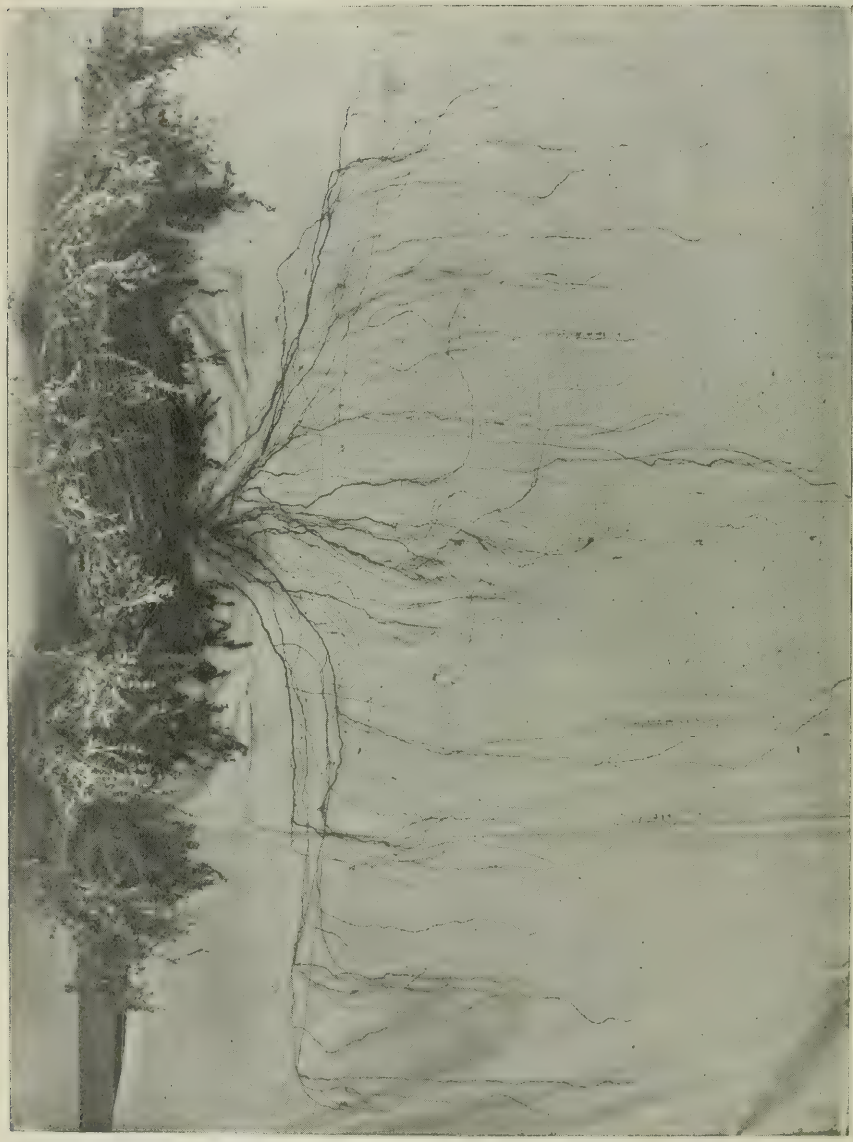


PLATE 12. ROOT SYSTEM OF SALTBUSH. TULARE.

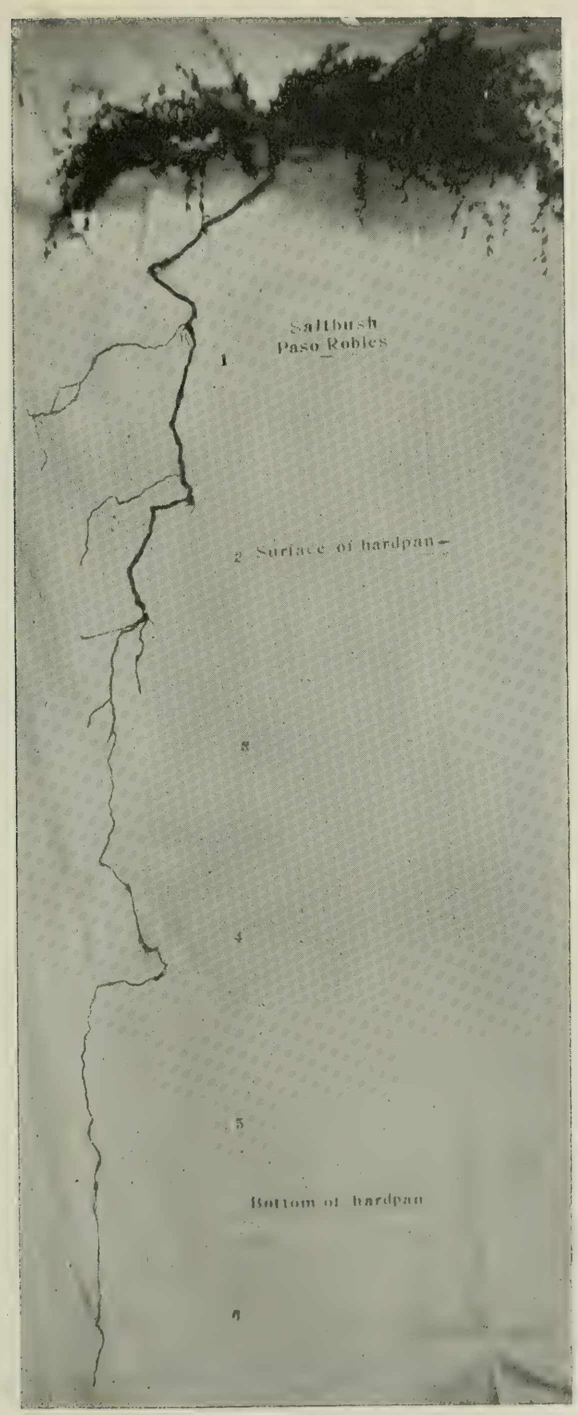


PLATE 13. Root System of Saltbush. Paso Robles.

Tulare County.—At the Experiment Station a patch of sorghum is growing on soil strong in alkali, and which constantly receives irrigation water. Two cuttings of the crop are made each year, the stalks growing about ten feet high. The soil is sandy and deep.

Eucalyptus and Acacia Trees.

Upon the middle mesa of the Forestry Station near Santa Monica, there are old groves of eucalyptus and acacia trees, and in the middle of each some of the trees had died, although the soil had been frequently cultivated.

On the upper mesa of the same station there is a new grove, and the young trees are growing well.

Samples of the soil of each of the three groves were taken in September.

Soil.	Locality.	County.	Condition of Crop	Moisture in Four Feet.			
				Percentage.			Tons per Acre—Free
				Total	Hygroscopic	Free	
	Saltbush.						
Sandy soil	Experiment Station, Tulare	Tulare	Good	4.9	3.0	1.9	152
Alkali land	Experiment Station, Tulare	Tulare	Good	14.4	6.0	8.4	672
Sandy mesa	Experiment Station, Paso Robles	San Luis Obispo	Good	6.2	2.1	4.1	328
	Hairy Vetch.						
Adobe	Economic Garden, University	Alameda	Good	11.9	8.8	3.1	248
	Soya Bean.						
Loam soil	Experiment Station	San Bernardino	Good	3.3	2.3	1.0	80
	Sugar Beets.						
Moist loam	Chino, 10-acre tract, Plot 41	San Bernardino	Good	26.7	7.2	19.5	1,560
Moist loam	Chino, 10-acre tract, Plot 100	San Bernardino	Exc'nt	18.7	7.2	11.5	920
Black loam	Oxnard	Ventura	Good	12.4	5.6	6.8	544
Black loam	Pajaro*	Santa Cruz	Good	14.6	8.6	6.0	480
	Sorghum.						
Alkali soil	Experiment Station	Tulare	Good	14.7	6.0	8.7	696
	Eucalyptus Trees.						
Loam of middle mesa	Santa Monica	Los Angeles	Dead	3.1	3.1	0	0
Loam of upper mesa	Santa Monica	Los Angeles	Fair	5.4	3.2	2.2	176
	Acacia.						
Loam of middle mesa	Santa Monica	Los Angeles	Dead	4.2	3.9	.3	24

* In the course of examinations in 1900 as to the cause of sugar beet blight, Mr. Bioletti also made soil-moisture investigations; at two places where no disease was found the following interesting results were obtained: A field near Watsonville, Santa Cruz County, where the beets were *poor*, held 4.6 per cent of free water, or 384 tons per acre. In a field near Salinas, Monterey County, where the beets were in *good* condition, there was 6.4 per cent of free water, or 512 tons per acre.

The Australian saltbush shows its adaptation to dry land by its growth in soils having less than 2 per cent of free moisture. At Paso Robles its roots penetrated several feet of hardpan through means of the softening influence of the little moisture upon the latter. (Plate 13.)

The sugar beet, although a water-loving crop, did well in black lands with but 6 per cent of free moisture, but suffered with 4.6 per cent. The failure on the Station ten-acre tract at Chino may possibly be due to the large excess of water, though this is doubtful, for the maximum water capacity of the soil is 54 per cent, and one half of saturation was not reached.

The death of the eucalypts and acacia was clearly due to the substrata of gravel and sand through which moisture could not rise by capillarity from any underground water source. The trees quickly used up the free water in the upper two feet of soil, leaving only the hygroscopic or that naturally held by the soil and not given to the tree. In the land of the upper mesa the moisture conditions were better, for the soil to the depth of several feet was loamy in character, its capillary power was greater, and therefore to the depth of five feet we find free moisture of more than 1 pèr cent above that held as hygroscopic.

MOISTURE IN VINEYARD LANDS.

Napa County.—Talcoa vineyard is situated in the foothills of the Coast Range, five miles west of Napa. It occupies the tops and slopes of hills on either side of a small valley that extends southward. The soils of the vineyard on the west and north are of a black clayey nature or adobe; those on the east are of the reddish nature peculiar to the hills bordering Sonoma Valley. Under all these soils there is usually, at the depth of three feet or less, a yellowish sandy hardpan. The soil of the valley is a dark stiff clay and quite deep.

The vines on the hillside near the wine cellar were in splendid condition when the samples were taken, July 30th. The soil is a heavy clay loam, quite full of moisture at three feet, and has a yellow clay hardpan at five feet.

On the north of the barn the land is also black and clayey, with the yellow loose material at four feet. The grapes were looking very well.

On the reddish hillside east of the house the soil was shallow and quite dry; hardpan occurred at from eighteen to thirty inches, which the auger would not penetrate. But the vines did not seem to suffer.

Other samples taken on the adobe hillside south of the residence showed the same features; yellow sandy hardpan at three feet, and excellent vines.

Yolo County.—A vineyard northeast of Woodland is located on a gravelly clay loam, and was in good condition on August 3d. Ground water stands at about ten feet below the surface.

Alameda County.—The soils of a vineyard at Mission San José are heavy adobes, largely underlaid at three feet by yellow sandy hardpan. The vines on the hillside facing to the south were not as thrifty on July 27th as those on the opposite slope, though the soil, the variety of grape, and the cultivation were the same. On the hilltop the vines growing on the same soil were in a thrifty condition.

Amador County.—Samples of soil were taken on August 25th from the Station vineyard located on land formed of granite and slate débris.

The vines were in rather poor condition. Below the stable of the Station the soil is a micaceous loam of granitic origin, and on this the vines were thrifty.

Tulare County.—Some of the vines in one part of the Station vineyard were suffering and their leaves dead, while near by they were in good condition.

San Bernardino County.—The soil of the Station is a reddish micaceous loam, rich in the elements of plant-food, but the vines were suffering severely on August 17th (No. 1), the grapes being very small. The land had been irrigated on May 28th. On October 3d, samples of soil were also taken from near the Petite Bouschet (No. 2) and the Cinsaut (No. 3) varieties.

Vineyard Lands.

Soil.	Locality.	County.	Condition of Crop.	Moisture in Four Feet.			
				Percentage.			Tons per Acre—Free.
				Total.	Hygroscopic.	Free.	
Dark clay loams	Talcoa Vineyard, west of Napa	Napa	Good	18.3	10.0	8.3	664
Dark clay loams	Talcoa Vineyard, west of Napa	Napa	Good	15.9	10.0	5.9	472
Adobe	Talcoa Vineyard, west of Napa	Napa	Good	13.2	10.1	3.1	248
Red lands	Talcoa Vineyard, west of Napa	Napa	Good	9.3	7.0	2.3	184
Loam	Woodland	Yolo	Good	6.9	5.0	1.9	162
Black adobe	Mission San José, south slope	Alameda	Good	13.2	9.0	4.2	336
Black adobe	Mission San José, north slope	Alameda	Good	11.2	9.0	2.2	176
Black adobe	Mission San José, hilltop	Alameda	Good	9.6	9.0	.6	48
Slate and granite débris	Expt. Station, Jackson	Amador	Poor	12.4	5.5	6.9	552
Gray loam	Expt. Station, Jackson	Amador	Good	12.5	8.2	4.3	344
Loam	Expt. Station, Tulare	Tulare	Dead	12.3	5.0	7.3	584
Loam	Expt. Station, Tulare	Tulare	Good	8.5	5.0	3.5	280
Dark loam	Expt. Station, Aug. 17th	S. Bernard'o	Poor	1.9	1.5	.4	32
Dark loam	Expt. Station, Oct. 3d	S. Bernard'o	Poor	1.7	1.5	.2	16
Dark loam	Expt. Station, Oct. 3d	S. Bernard'o	Poor	1.7	1.5	.2	16

All of the soils of the Talcoa vineyard were well supplied with moisture in the free state, and the vines were therefore in a flourishing condition. This was especially true of the dark loams and adobe; the red, because of the presence of hardpan at the depth of four feet, should perhaps have a better supply, for the roots are limited in their penetration to the shallow soil, but the vines were not suffering at the time of visit.

The vineyards visited in Alameda, Amador, and Tulare counties were in good condition and the amount of moisture was evidently sufficient; an exception occurred in the Mission San José vineyard, where on the slope facing south the vines for some unexplained cause were not as thrifty as on the slope opposite, though having more water.

The moisture in the land of the Southern California substation was extremely small on August 17th, and was lessened a little during the

next forty-five days; the amount was scarcely above the hygroscopic demands of the soil, leaving but little free moisture for use of the vines. While, therefore, the latter could maintain existence on the scant supply, a good growth could hardly be expected unless irrigation be resorted to.

MOISTURE IN ORCHARD SOILS.

Almonds.

Yolo County.—In the orchard of F. G. Childs, east of Davisville, the trees had, on August 1st, lost their leaves with the exception of a belt of about ten trees in width, running diagonally from northeast to southwest, in which no suffering was apparent. The soil of this belt was rather moist at four feet, while in the rest of the orchard the moisture was not noticeable. The land is of the Putah Creek alluvium, with intercalated beds of almost pure sand. Samples of the soil were taken from the belt of good trees (1) and from the land just outside of the belt (2) for examination.

An almond orchard at Swingle Station is upon deposits from Putah Creek, consisting of about ten inches of a fine silty crust and an understratum of sand intercalated with layers of a yellow silty clay, each an inch or so thick. Upon a portion of the orchard tract the trees were rapidly losing their leaves on August 2d; here at three and one half feet the soil was wet. On the rest of the tract the trees were looking much better; here the soil was hard and compact to a depth of fifteen inches, but the soil was drier and the silty layers occurred to a depth of at least seven feet.

In the Oak Shade orchard, located on the sandy loam bordering Putah Creek east of Davisville, the ground was found on August 2d to be very hard and dry, having been apparently cultivated only once and then left idle because of the loss of the fruit from frosts. The trees were large, but mostly without their leaves.

In the orchard of J. Milks, four miles east of Davisville, the soil is a moist clayey loam, receiving excessive cultivation; the trees were looking well.

The trees on the place of W. Montgomery, east of Davisville, were on a sandy loam soil, twelve inches deep, with an understratum of sand and loam. An adobe is said to occur at fourteen feet below the surface, where water is found. The trees were seven years old, and their small roots were found at ten inches from the surface. The soil is of a loose character, does not bake in dry seasons, and receives but one cultivation in the spring, when the growth of alfileria, about six inches high, is turned under. The trees all looked well on August 2d.

The Yolo orchard, situated on the alluvial lands of Cache Creek north of Woodland. One portion of the tract had received no irrigation, and the trees were almost leafless when visited. Another portion had been irrigated about six weeks previous to taking the samples, the water being allowed to soak in around each tree for from one half to three fourths of an hour. The trees here were putting on new buds, and suckers or water-shoots had grown about eighteen inches.

Soil.	Locality.	County	Condition of Trees	Moisture in Four Feet. Percentage. Total	Hygroscopic	Free	Tons per Acre—Free
Alluvial loam	1 mile east of Davisville, Childs	Yolo	Good	8.5	6.6	1.9	178
Alluvial loam	1 mile east of Davisville, Childs	"	Suff'ng	7.9	6.9	1.0	80
Sandy soil	Swingle Station	"	Fair	5.6	5.6	0	0
Sandy loam	East of Davisville, Oak Shade	"	Suff'ng	8.7	8.4	.3	24
Clay loam	4 miles east of Davisville, Milks	"	Good	15.5	10.0	5.5	440
Sandy	4 miles southeast of Davisville, Montgomery	"	Good	10.8	6.0	4.8	384
Loam	Yolo Orchard	"	Leafl's	11.2	9.8	1.4	112
Loam	Yolo Orchard, after irrigation	"	Newg'h	12.4	9.8	2.6	208

It is evident from these results that the almond must have more than one per cent of free moisture to prevent suffering, even in loose sandy loams where its roots can spread freely. In heavy soils, where the roots are restricted to smaller areas, the amount should be greater for safety.

The accompanying photograph (plate 14) shows the root penetration of an almond tree in a loam soil on the place of Hon. George Pierce, west of Davisville. The roots reach to a depth of more than five feet.

In the orchard of J. Milks, east of Davisville, the amount of moisture was much larger than at Swingle, and yet the trees were not suffering. In this case the soil was a clay loam with a water capacity of saturation of about 40 per cent of its weight, and the amount of water present is therefore below the danger point of one half.

The same is true of the Cache Creek alluvial land of the Yolo orchard.

The Montgomery orchard is on a deep sandy soil, well supplied with moisture; its excess at the third foot diminishing below, and hence giving sufficient aëration.

Suffering from Excess of Moisture.—In the sandy soils of Putah Creek at Swingle Station, Yolo County, a number of trees were found to be in distress. Examination showed that the upper three feet contained more than 8 per cent of moisture, of which fully one half was free for the use of the tree. The fourth foot, however, was quite wet, holding more than 15 per cent of water, as shown in the following table:

	First Foot.	Second Foot.	Third Foot.	Fourth Foot.
Total moisture per cent	6.9	8.0	9.9	15.3
Tons per acre	138	160	198	306

The water contained in the fourth foot was near the point of saturation for so sandy a soil, thus crowding out the air so necessary for the life of the plant, and drowning out the fine rootlets with their absorbent

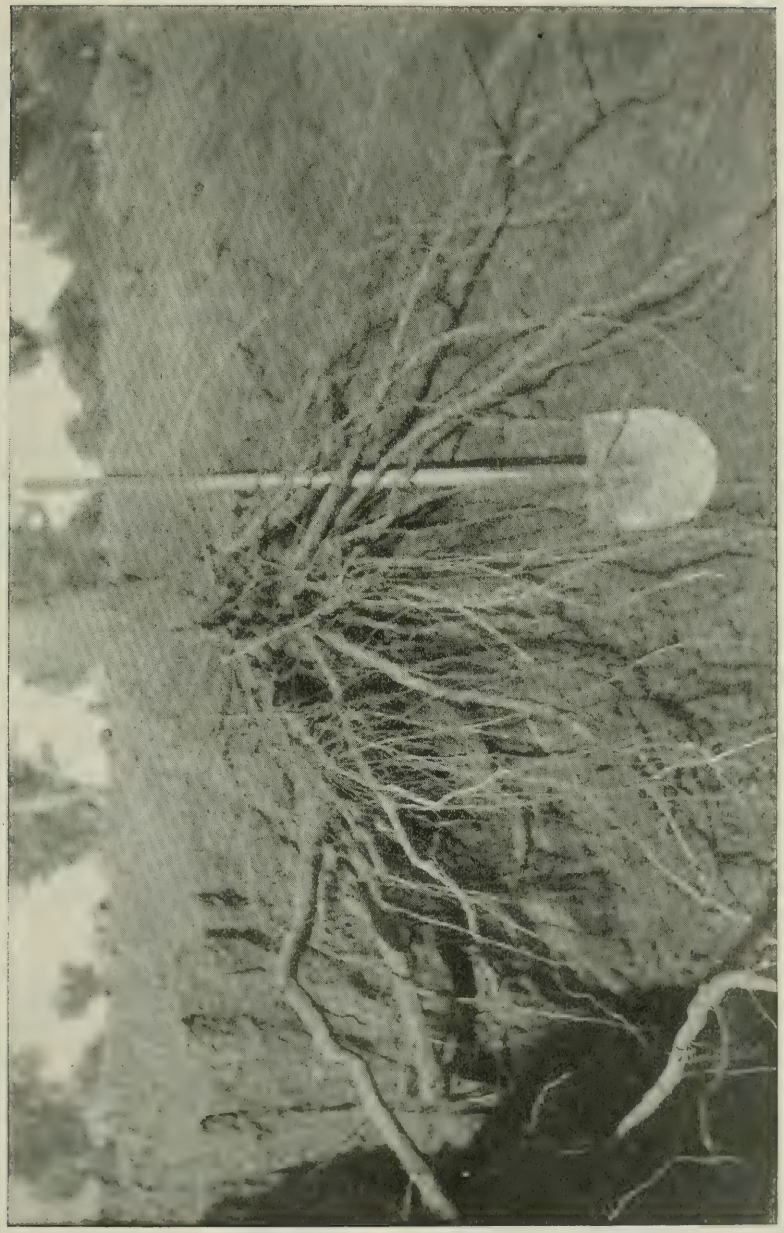


PLATE 14. Almond Tree, Showing Root Penetration.

root-hairs; with one half the amount of moisture, the neighboring trees were doing well.

This is in confirmation of the rule that the amount of moisture in a soil should, for best results, not be more than one half of the water capacity of that soil, or of that required to saturate that soil. In this case the water capacity of the Swingle soil is about 20 per cent of its weight, and therefore there should not have been more than 10 per cent of moisture in that fourth foot. In the Oak Shade orchard the suffering was doubtless due to the hard, compact condition of the soil, which prevented proper ventilation and aëration for the rootlets.

Apples.

Ventura County.—The trees of an apple orchard on the place of H. W. Gibson, four miles east of Ventura, were loaded with fruit and in excellent condition. The soil is the silty loam of the Saticoy Plains, which reaches from the mountains several miles to the ocean. The soil was not deeply plowed and the trees were not large. The samples of soil were taken on September 8th.

San Luis Obispo County.—Samples of the soil of the Arroyo Grande Valley were taken on September 17th from an apple orchard near the town of Arroyo Grande. The trees looked well, but had been badly cultivated, the ground left very cloddy and in ridges. The trees had received no irrigation; the water level occurs at about thirteen feet from the surface.

Samples of soil were taken on August 15th and October 15th respectively from apple orchards on the east and west sides of the Experiment Station at Paso Robles. Both tracts were well cultivated. The new growth of the trees on the east was four feet and that of the west eighteen inches.

Monterey County.—A small orchard of various fruits is located on the hills near Pacific Grove, and among them were apple trees. The soil is very sandy for two feet in depth, when it becomes semi-cemented with a little clay, and at three or four feet is very moist from an underflow of water over a clay bed. Samples were taken on August 11th.

Yolo County.—An orchard of fine large trees is located on the banks of Putah Creek, just west of Davisville. The soil is a rich alluvial loam, well cultivated. Samples were taken on August 1st.

Soil.	Locality.	County.	Condition of Trees.	Moisture in Four Feet.			
				Percentage.			Tons per Acre—Free
				Total	Hygroscopic	Free	
Loam	Four miles east of Ventura	Ventura	Excellent	8.3	5.5	2.8	224
Sandy	Pacific Grove	Monterey	Excellent	6.5	1.9	4.6	388
Loam	Davisville	Yolo	Excellent	9.0	6.0	3.0	240
Clay loam	Arroyo Grande	San Luis Obispo	Excellent	19.1	10.3	8.8	704
Calc's sandy	Expt. Station, Paso Robles, Aug. 15	San Luis Obispo	Growth 4 feet.	16.1	8.6	7.5	600
Calc's sandy	Expt. Station, Paso Robles, Oct. 25	San Luis Obispo	Growth 4 feet.	15.4	8.6	6.8	524
Adobe	Expt. Station, Paso Robles, Aug. 15	San Luis Obispo	Poor	12.3	10.8	1.5	120
Adobe	Expt. Station, Paso Robles, Oct. 25	San Luis Obispo	Growth 18 in.	15.3	10.8	4.5	360

The minimum amount of free water in the above examination was 2.8 per cent in the loam soils of Ventura County, and even with this small amount the apple trees were in good condition in September. This is probably near the lower limit in which this fruit will flourish, and is less than the prune or apricot.

The alluvial lands of Arroyo Grande and Putah Creek have evidently a source within reach from which to supply the loss by evaporation as rapidly as the moisture passes upward, for the percentage present is high. The Arroyo Grande Valley should not suffer from drought.

It was a matter of much surprise that the sandy lands of the plateau on which the Experiment Station at Paso Robles is situated should contain so large a percentage of water, especially in its hardpan beds. It is doubtless due to the close, compact condition of the sand, silt, or clay composing the hardpan, which is thus enabled to hold the water quite tenaciously. This is also shown in the high hygroscopic power of the soil.

Penetration of Roots.—The abrupt lowering of the percentage in the fourth foot of each of the soils of the east and west sides of the station evidently marks the points at which the fine absorbent root-hairs on the rootlets withdraw the moisture for the use of the tree.

The tenacious retention of moisture by the soil is also shown in the fact that very little loss occurred between the August and October tests on the east side, while on the west there was a gain in five of the seven feet examined.

Apricots.

Santa Barbara County.—In Sisquoc Valley, one mile east of Gary, on the place of L. M. Kiser, apricot trees were looking well on September 16th. The soil is a dark clay loam, but in which a plow-hardpan had been allowed to form by continuous cultivation to a depth of only three inches.

An orchard on the place of Prof. Snow, in the northern part of the city of Santa Barbara, and 220 feet above sea-level, contains a variety of fruit trees, among which were apricots, in excellent condition on September 7th. The soil is a reddish loam and quite deep.

An apricot orchard upon the hills in the region of Montecito was found in a neglected condition, the soil hard and cloddy, and but few leaves upon the trees. The soil is a yellow loam, with a hardpan at two feet; rather moist, but almost too hard for root penetration.

Ventura County.—The orchard of B. T. Williams, three miles east of Ventura, is located on the broad plain of silty loam soils that spreads out several miles from mountain to ocean. This orchard had received only a shallow cultivation of about three inches; the trees were not thrifty and had made a new growth of only about six inches.

Another orchard not far distant, Dudley's, had a somewhat heavier soil, which had been plowed deeply every second year and also received deep cultivation regularly. The trees were in good condition and had made a new growth of three feet.

Another orchard, on the place of H. W. Gibson, four miles east of Ventura, had not received the deep plowing but shallow cultivation. The new growth of the trees was also only about eight inches.

San Luis Obispo County.—On the Los Berrios hills or mesa south of Arroyo Grande Valley, and at an elevation of 150 feet above the sea-

level, is the large apricot orchard of Mr. A. Phillips, the trees of which are five years old. The soil is almost a pure sand, and said to be underlaid at sixteen feet by a yellow clay, changing to a blue clay below. The water-bearing gravel lies at about sixty-eight feet below the surface. The trees were looking well on September 17th.

Alameda County.—In the region of Niles there were three orchards, situated on the rich alluvial lands of Alameda Creek, which differed so prominently in the treatment received and in their appearance that they have been already mentioned on page 57. One of these had received no cultivation for two years; ground had become hard to several inches depth; leaves of trees small and scanty. Fruit very small, and new growth of wood only a few inches.

Apricot orchard, adjoining this on the south. This had received a three-inch cultivation; the trees, while in better leaf than the former, were suffering for want of moisture; the leaves were wilting. The fruit was very good. Gravel at four and one half feet.

Apricot orchard on the north of the first. This orchard had received deep and excellent cultivation; the trees looked well and the fruit was large. The new growth on the trees was about three feet.

The soils of the above orchards are similar rich alluvial loams of Alameda Creek, and the differences in appearance of the trees were due entirely to differences in care and cultivation, which controlled the moisture.

Yolo County.—The soil of an orchard near Woodland is a clay loam, with bottom water at about ten feet; the young trees had made a new growth of five feet. On a higher part of the orchard, the trees were planted among grapevines, where the soil was gravelly. The trees were suffering severely and had made but little new growth.

East of Davisville, on the place of E. Snider, where the soil was so sandy that it caved in almost as rapidly as opened out by the shovel in securing samples, a tree was in excellent condition and had made a new growth of about five feet.

Soil.	Locality.	County.	Condition of Trees.	Moisture in Four Feet.			
				Percentage.			Tons per Acre—Free
				Total	Hygroscopic	Free	
Dark loam	Sisquoc Valley	S. Barbara	Good	5.5	3.1	2.4	192
Loam	East of Ventura, shallow cult.	Ventura	Growth 6 in.	6.5	5.5	1.0	80
Loam	East of Ventura, shallow cult.	Ventura	Growth 8 in.	5.6	4.2	1.4	112
Loam	East of Ventura, deep cult.	Ventura	Growth 36 in.	9.3	5.5	3.8	304
Sand	Los Berrios Hills	S. L. Obispo	Good	1.7	.8	.9	72
Loam	Experiment Station	Tulare	Good	6.1	5.0	1.1	88
Loam	Niles, no cultivation	Alameda	Very poor	4.4	4.4	0	0
Loam	Niles, cultivation 3 ins.	Alameda	Fair	5.4	3.3	2.1	168
Loam	Niles, cultivation 6 ins.	Alameda	Excellent	6.3	3.3	3.0	240
Black clay	Woodland	Yolo	Excellent	18.8	9.6	9.2	736
G'v'ly loam	Woodland	Yolo	Poor	6.9	5.0	1.9	152
Sand	E. of Davisville, Snider	Yolo	Good	4.8	3.6	1.2	96
Alluvial	Davisville	Yolo	Good	9.0	6.9	2.1	168

The dark loam of the orchard east of Gary, in Sisquoc Valley, on which were prunes, apricots, and other fruits, is rich in its character,

and lying as it does but a few feet above the Sisquoc River, should naturally contain an abundance of moisture. But comparatively little was found at the time the samples were taken, and that was contained chiefly in the upper two feet. The apricot trees did not seem to suffer with this 5.5 per cent of moisture, while the prunes felt the lack of it. The hot, dry season was evidently rapidly drying out the soil, in spite of the three-inch cultivation.

The result of the examination of the silty loams of the country east of Ventura shows the importance of deep and thorough cultivation of the soil, for the amount of free water saved thereby enabled the trees to take on a new growth of several feet; this is quite in contrast with that of the shallow cultivation. The same is true of the apricot orchards at Niles in Alameda County, where the orchards were nearer together than in Ventura and hence more nearly under the uniform conditions in soil, etc.

The good condition of the apricot trees upon the sandy hills of Los Berrios Creek near Arroyo Grande was a matter of surprise until the examination showed the presence of moisture in excess of that required to satisfy the hygroscopic demand of the soil.

Citrus Trees.

Santa Barbara County.—In the northern part of the city of Santa Barbara, on the place of Mr. Snow and at an elevation of about 220 feet above the sea, some citrus trees were in good condition on September 7th; they had received no irrigation. The soil is a yellow loam and quite deep.

A small lemon grove was planted in the low flat adjoining the creek on the place of Mr. R. A. Gould in Montecito; the trees had lost their leaves and were not doing well. The soil was found to be only about two feet deep to a very heavy bed of cobblestones. Soil had filled the spaces between the stones, and in this the roots of the trees were trying in vain to obtain water. The soil contained only about 4 per cent of water.

Riverside County.—The orchards in the vicinity of Corona have all been under irrigation for a number of years: a portion with the alkaline waters of Lake Elsinore and another portion with the purer waters of artesian wells. The trees of the first group had lost much foliage, while the artesian group were in full vigor. Examinations were made as to the water content of the soils of the respective systems, with a view of ascertaining the cause of suffering. In the tables, the first of the list (B) was receiving artesian water, and the trees were in excellent condition. All of the others had been watered from the lake, and were suffering, many of them very badly.

Los Angeles County.—The trees of an orange grove a short distance east of Fernando, about nine years old, were rapidly losing their leaves on September 3d. The soil was not deeply cultivated, for a hardpan was observed at three inches lying above a gravelly soil. The fine feeding rootlets of a tree were found at two feet.

Alameda County.—Upon a tract of adobe in a vineyard near Mission San José, a young orange tree was seen which had lost its leaves, although large *mulberry* and *carob* trees near it were in excellent condition, their roots doubtless having penetrated deeper into the soil and secured necessary moisture.

Amador County.—The orange orchard of the Experiment Station is situated near the main avenue, and upon a southern slope. Good cultivation had been given to the land, and the trees were in good condition.

Soil.	Locality.	County.	Condition of Trees.	Moisture in Four Feet. Percentage. Total	Hygroscopic	Free	Tons per Acre—Free
Yellow loam	Santa Barbara	Santa Barbara	Good	5.2	3.8	1.4	112
Yellow loam	Corona, B.	Riverside	Good	6.3	3.1	3.2	256
Alkali loam	Corona, J. M.	Riverside	Fair	10.2	5.5	4.7	376
Alkali loam	Corona, C.	Riverside	Losing leaves	7.9	3.0	4.9	352
Alkali loam	Corona, S. W. L.	Riverside	Leaves falling.	13.4	5.6	7.8	624
Sandy soil	Fernando	Los Angeles	Leafless	3.1	2.4	.7	56
Black adobe	Mission San José	Alameda	Leafless	10.0	10.0	0	0
Dark red clay	Experiment Station	Alameda	Good	15.4	8.6	6.8	544

The results from Santa Barbara and the B. orchard in Corona indicate that the orange tree will do well if the soil to several feet depth has for its constant use 2 or 3 per cent of free moisture or that percentage above the hygroscopic condition. Thus these two orchards had in all from 5.2 to 6.6 per cent, of which a little more than 3 per cent was hygroscopic, and the remainder free. In heavier lands a larger total is necessary, for a larger amount will be required to satisfy the demand of the soil itself. Thus in the Mission San José adobe the 10 per cent found was all hygroscopic, and no free moisture was present to even keep the leaves of the orange trees from falling off.

The other Corona orchards had apparently an abundance of moisture, but the trees were suffering from the presence of alkali salts.

The Fernando orchard land was shallow and sandy, and the trees had withdrawn the moisture to such an extent that not enough remained to keep the leaves from falling.

The Foothill substation trees received an underflow of water from irrigation on the hill above, and though there was nearly an excess of moisture in the soil for the trees, they were in good condition.

Cherries.

Cherry trees of the Southern California substation, growing on a micaceous sandy loam soil, were suffering severely in August. An examination of the soil showed the presence of only 2 per cent of moisture in four feet depth, an amount not sufficient to satisfy the hygroscopic conditions and giving none to the tree.

Figs.

Santa Barbara County.—In the north of the city of Santa Barbara, on the place of Mr. Snow, figs were found in good condition. The soil is a red loam, and had received good cultivation.

Tulare County.—A fig tree on the Experiment Station tract, near Tulare, was looking well, while adjoining it some of the grapevines were suffering. Samples of the soil were taken on September 20th.

Alameda County.—Near the cottage on a large vineyard at Mission San José there are several fig trees growing in a compact black adobe soil. The leaves of the trees were in a wilting condition on July 20th, when the samples of soil were taken.

Soil.	Locality.	County.	Condition of Trees.	Moisture in Four Feet. Percentage. Total	Hygroscopic	Free	Tons per Acre—Free
Red loam	Santa Barbara	Santa Barbara	Good	5.2	3.8	1.4	112
Loam soil	Expt. Station, Tulare	Tulare	Good	8.5	5.0	3.5	280
Black adobe	Mission San José	Alameda	Wilting	8.6	8.6	0	0

The most important point in the comparison of these results is that while the fig was living well in the Santa Barbara loam land with only 5.2 per cent of moisture, it suffered greatly in an adobe with 8.6 per cent of moisture, a difference of 256 tons of water in a depth of four feet of soil; thus illustrating the difference in the amount required to satisfy the demand of each character of soil. In the adobe land there was no free moisture, while in the loam the tree secured more than one per cent. The fig is evidently not as thirsty a tree as some others.

Olives.

Los Angeles County.—Northeast of Fernando there is a large olive orchard, four years old, located on a sand and gravel débris from Wilson's Cañon, about a mile distant. The trees were suffering when visited on September 3d, and the small roots of the trees were found at a depth of one and two feet.

In another portion of the orchard, adjoining a peach orchard, the soil was better, and the trees were a little more thrifty looking, the soil here showing an average of about 2.5 per cent of moisture in three feet.

Tulare County.—Upon the Experiment Station tract olive trees have been planted near the east fence, and others near the stables in the central part of the grounds. In order to ascertain the differences in moisture in the soils of the two localities, samples were taken on September 20th.

Soil.	Locality.	County.	Condition of Trees.	Moisture in Four Feet. Percentage. Total	Hygroscopic	Free	Tons per Acre—Free
Sandy soil	Fernando	L. Angeles	Suffering	1.9	1.9	0	0
Red loam	Santa Barbara	S. Barbara	Good	5.2	3.8	1.4	112
Sandy loam	East of Santa Maria	S. Barbara	Fair	2.3	2.0	.3	24
Loam	Expt. Station, east fence	Tulare	Good	8.1	5.0	3.1	248
Loam	Expt. Station, near stable	Tulare	Good	3.4	2.0	1.4	113

The loose sand and gravel of the orchard near Fernando naturally holds but little moisture, and where the depth is great can draw but little from the source below. The water-holding power of such a soil is also very low; the downward percolation of rain or irrigation water is very rapid until arrested by a more compact stratum. It is not, therefore, surprising that there was but 1.9 per cent present in the soil at the time the samples were taken. It is interesting to note, however, that while the olive trees were suffering, they still lived and had not entirely lost their leaves in so small moisture supply.

In the sandy loam soils east of Santa Maria the amount of moisture is also at the minimum, or about that absorbed from the air and not in the free state. The soil is of a finer texture than that at Fernando, and therefore naturally absorbs more moisture.

Of the two plots at Tulare substation, that near the east fence is the heavier and finer in texture, that at the stable being quite sandy; there is naturally a higher water content in the former. Free moisture existed at the lower depths in each location, upon which the trees could draw for their supply; the surface in each case was very dry.

Peaches.

Monterey County.—The soils of the Fort Romie tract of land west of Soledad are sandy loams for the most part, and quite level. The peach trees near the center of the tract were in good condition on August 13th, when the samples of soil were taken.

San Luis Obispo County.—The soil of the peach orchard of the Experiment Station grounds near Paso Robles is sandy, with a compact hardpan at four feet. The trees were in a healthy condition and had made a new growth of from 12 to 36 inches. The first samples were taken on August 15th, and the second in October in order to ascertain the loss during this period.

Soil.	Locality.	County.	Condition of Trees	Moisture in Four Feet.			
				Percentage.			Tons per Acre—Free
				Total	Hygroscopic.	Free	
Red soil	Experiment Station	Amador	Poor	6.8	5.0	1.8	144
Red soil	Experiment Station	Amador	Good	8.2	5.0	3.2	256
Sandy loam	Fort Romie, near Soledad	Monterey	Good	8.7	4.6	4.1	328
Sandy soil	Experiment Station	San Bernardino	Good	2.8	2.4	.4	32
Sandy soil	Experiment St'n, Paso Robles, Aug. 15	San Luis Obispo	Good	3.3	1.9	1.4	112
Sandy soil	Experiment St'n, Paso Robles, Oct. 25	San Luis Obispo	Good	2.6	1.9	.7	56

Upon the red clay soil of the Foothills substation in Amador County, the lack of sufficient moisture would seem to be the cause of suffering in the peach trees, for the amount present in the four feet was only a little above that which is naturally held by the clayey soil as hygroscopic moisture. Where the trees were doing well the amount of moisture was much greater, there being a large excess of free water above the hygroscopic moisture.

In the Fort Romie soil there is an excellent amount of moisture for so sandy a soil, and if the supply is continuous from the lower depths of the land, there is no need for irrigation in supplying moisture to these trees.

It is interesting to note that while the land of the orchard in the Southern California substation had but little more moisture than naturally held as hygroscopic moisture, there is a sudden falling off in the percentage at the fourth foot, where doubtless are located the feeding rootlets of the tree; these, at that time, were clearly actively engaged in pumping up water from this point into the plant.

The land of the orchard at the Paso Robles substation had, in August, some free moisture, but in the succeeding seventy days had lost it by evaporation either from the surface or through the leaves of the trees; the amount was then reduced almost to that naturally held as hygroscopic and barely sufficient for the needs of the trees.

Pears.

Napa County.—Soils from the place of J. T. Edwards, two and a half miles west of Napa, were taken on July 30th. This place is on the border of the foothills, elevated a little above the valley; the soil is a reddish loam, about two feet deep, underlaid by a stiff clay. On the hillside the soil was kept in good tilth by cultivation and the young pear trees looked well. Just beneath them, on a lower plain, however, the pear orchard of old trees had been planted in grain, and since the latter had been cut the surface of the soil had become quite compact and hard. Two weeks previous to the taking of the sample the leaves of the trees began to droop. The trees are about twenty-five years old.

Yolo County.—The orchard of Mr. Blowers, four miles west of Woodland, is upon a rich alluvial loam, quite deep and in good cultivation, excepting that a plowsole or hardpan had formed at six inches. The trees were all looking well.

San Bernardino County.—The trees on this part of the Experiment Station were upon a sandy soil. The leaves wilted during the day, but recovered at night. The samples were taken from between two trees of the *Court Queen d'Autumn* pears on June 9, 1898. The trees had been irrigated twice since winter, and had looked thrifty until a few days before the samples of soil were taken; now they curled up during the warmest part of the day, while smaller trees did not show the same distress. There had been no growth to the trees for some time.

Soil.	Locality.	County.	Condition of Trees.	Moisture in Four Feet.			
				Percentage.			Tons per Acre—Free
				Total	Hygroscopic	Free	
Clay loam	West of Napa, old trees	Napa	Leaves fall'g	13.2	8.7	4.5	360
Dark loam	West of Napa, y'g trees	Napa	Good leaf	11.6	8.0	3.6	288
Alluvi'l loam	4 m. w. of Woodland	Yolo	Good	13.8	9.3	4.5	360
Loam	Experiment Station	Tulare	Good	11.9	5.0	6.9	552
Sandy	Experiment Station	S. Bernard'o	Wilting	2.5	2.0	.5	40

The falling of the leaves from the old pear trees of the lower portion of the orchard west of Napa was probably due to some other cause than ack of moisture supply, for the amount of the latter was much larger than where the young trees were in full leaf. Perhaps the compacting of the soil and the consequent lack of aëration for the roots produced the trouble. The leaf surface of the old trees was also greater.

The moisture in the soils of the orchards both from Yolo and Tulare was large in amount, and showed the influence of good cultivation in preventing excessive loss by evaporation from the surface.

The sandy soil of the Southern California substation contained very little free moisture for the use of the trees, the 2.5 per cent present being about that naturally absorbed from the atmosphere. This was, however, sufficient to prevent the death of the trees, though not enough to prevent wilting of the leaves.

Plums.

Amador County.—On the red slate soil of Reservoir hill at the Experiment Station the trees produced poor fruit; it did not always mature, but dried up and fell off. The trees that bore no fruit had a new growth of twelve to twenty inches. On the gray sandy granitic land at the base of the hill, the plums made a good growth and produced good fruit. The samples were taken on August 25th.

Soil.	Locality.	County.	Condition of Trees.	Moisture in Four Feet.			
				Percentage.			Tons per Acre—Free
				Total	Hygroscopic	Free	
Red loam soil	Experiment Station	Amador	Poor fruit.	6.7	6.2	.5	40
Gray sandy land	Experiment Station	Amador	Good fruit.	7.3	5.5	1.8	144

In the plum orchard of the Foothill substation of Amador County the gray sandy granitic lands had more moisture than the more clayey red slate, a somewhat surprising condition. The latter had but little free water, while the low hygroscopic nature of the sandy soils afforded an amount of free moisture that was shown in the better growth of the trees.

Prunes.

Yolo County.—Just west of Davisville and on the south of the railroad, there is a tract of land which was overflowed several years ago by the waters of Putah Creek and "drowned out." A prune orchard occupies a portion of the tract, but its trees were, in August, entirely without leaves. The soil was only a hard mass, from the lack of cultivation.

In an adjoining orchard the ground had been plowed, but left in ridges and allowed to grow up in grass. The soil was a hard mass to several feet in depth and the trees almost leafless.

In the Briggs orchard, on the bank of Putah Creek, near Davisville, the trees were in excellent condition on August 1st; the soil was well cultivated.

A prune orchard east of Davisville (S.) is upon a soil made up largely of alluvial loam with thin layers of sand, underlaid by a subsoil of gravel to the fourth foot and probably deeper. The prune trees had lost their leaves, and the fruit that remained on the limbs was very small. The trees were exuding gum.

The trees of the Jackson orchard, four miles south of Woodland, were all in fine condition and the fruit large. They had been irrigated in the spring. Grapevines were growing between the trees.

The prune trees of the Yolo orchard had been attacked by the red spider, and a portion of the trees were almost leafless. Otherwise they were in splendid condition. To note the effect of defoliation of the trees upon the moisture content, samples of soil were taken from beneath leafless trees and from those in full leaf.

Santa Barbara County.—In an orchard one mile east of Gary, in Sisquoc Valley, the prune trees were losing their leaves, while apricots were doing well. The soil of the orchard is a dark loam, cultivated to the depth of only three inches and leaving a plow hardpan below.

Los Angeles County.—The trees of an orchard one mile east of Fernando, and two miles from the mountains, were growing in a sandy loam soil, but suffering from lack of sufficient moisture. They were six years old.

Santa Clara County.—The lands around Campbell Station are loams more or less gravelly and deep. A well on the place of F. M. Righter showed rock and gravel at eighty feet, underlaid by a water-bearing stratum of blue clay at ninety feet.

Three orchards were visited on August 15th; one on the place of Charles Cooper, which had received no irrigation; the trees had lost most of their leaves and the fruit was small in size.

Another on the east of town, belonging to F. M. Righter, had been irrigated on April 15th, but the soil was very porous and received the water as fast as it could be delivered. The ten acres received in seventyt three hours an amount about equal to 14.5 tons per acre. On August 16th the leaves of the trees had a wilted appearance during the day, but freshened up at night.

The orchard of O. N. Bagwell, on the opposite side of the road, had been irrigated on April 5th and on June 23d, and the trees had kept fresh and vigorous.

Alameda County.—An orchard situated on the rich alluvial land of Alameda Creek at Niles showed no signs of distress in July. The roots on one side of one of the trees near the bank of the creek were exposed by excavation to a depth of eight feet to ascertain the nature of their development (see photograph, page 42), and samples of soil were taken for moisture determinations.

Soil.	Locality.	County.	Condition of Trees.	Moisture in Four Feet.			
				Percentage.			Tons per Acre—Free
				Total	Hygroscopic	Free	
Loam	West of Davisville, uncultivated	Yolo	Leafless	6.8	6.8	0	0
Loam	West of Davisville, uncultivated	Yolo	Almost leafless	11.0	9.8	1.2	96
Loam	West of Davisville, cultivated	Yolo	Excellent	9.0	6.0	3.0	240
Loam	East of Davisville, cultivated	Yolo	Poor	6.4	5.4	1.0	80
Loam	South of Woodland, cultivated	Yolo	Good	8.0	5.4	2.6	208
Loam	Yolo orchard, in full leaf	Yolo	Good	11.2	9.0	2.2	176
Loam	Yolo orchard, defoliated by insects	Yolo	Good	12.1	9.0	3.1	248
Black clay	East of Gary, Sisquoc Valley	Santa Barbara	Suffering	5.5	3.1	2.4	192
Sandy soil	Fernando	Los Angeles	Suffering	3.9	3.1	.8	64
Dark loam	West of Campbells	Santa Clara	Suffering	6.3	6.1	.2	16
Dark loam	West of Campbells, irrigated once	Santa Clara	Drooping	8.4	6.1	2.3	184
Dark loam	West of Campbells, irrigated twice	Santa Clara	Good	8.2	4.3	3.9	312
Loam	Niles	Alameda	Excellent	6.6	3.3	3.3	264

The amount of free water in the soils of the orchard just west of Davisville is, in two of the places, abundant for the tree, but in the leafless orchard the trees were clearly suffering from a lack of moisture in the soil. In the almost leafless trees, where there was 11 per cent of total moisture, there was just enough in the free state to enable the trees to retain a part of their leaves.

In the land east of Davisville, where the sand is intercalated with thin layers of clay, the influence of the latter upon the retention of moisture was clearly seen in the difference between the percentages in the second and third foot. At the same time it may be said that this is but little above that absorbed naturally from the air by this character of soil.

The latter is true also of the first foot and of the soil as a whole, the fourth foot alone having a larger percentage. The distress in the trees may therefore be attributed in part to insufficiency of moisture.

In the prune orchard south of Woodland, the supply of moisture was found to be abundant, and the trees were therefore in a healthy condition.

The difference of 72 tons in water-content in the soils of the trees in full leaf and those defoliated, in the Yolo orchard, is due of course to the withdrawal by evaporation through the leaves. It was further emphasized in the detailed examination, which showed less water in the third foot, or where the feeding roots of the good trees were pumping the water to the leaves; while on the other hand the affected trees, having lost nearly all of their leaves, made but little demand on the moisture, and hence a more even distribution and a somewhat larger amount of moisture was observed in the soil.

It is an unusual and peculiar circumstance that in the black clay loam of the prune orchard a mile east of Gary, in the Sisquoc Valley, the greater part of the moisture should be found in the upper two feet, leaving but very little below that depth. Evaporation from the surface of the ground had evidently drawn to the top all that was possible, leaving only that which the soil naturally absorbs and holds against capillary movement, as well as largely against absorption by the feeding rootlets; the latter probably existed at the third or fourth foot, and the trees were therefore unable to secure sufficient moisture to prevent suffering.

The same is true of the Fernando orchard, where the trees were suffering.

In the samples from Campbell Station we have three conditions: unirrigated land, upon which the prune trees had lost most of their leaves and whose fruit was small and nearly all gone, and land which had been irrigated, once and twice respectively, whose trees were in excellent condition. The results of the examination show that in the former there was about 0.2 per cent of free moisture, and insufficient for the supply of the trees; while in the other orchards the supply of 2.3 per cent was fully adequate. It is interesting to note that the orchard receiving an irrigation only in April was as well supplied with total moisture as that which had been irrigated both in April and in June, but its free water was less and just sufficient for the trees. In the former the application of water was doubtless so much the more generous that the lower depths of the land received it and held it. This is a point in favor of winter irrigation, provided it be thorough and be followed by proper cultivation to aid in its retention.

The land of the orchard at Niles shows a fair amount of moisture in the upper four feet as compared with other orchards, but is about the limit which the prune seems to demand as a constant supply—246 tons of free water per acre. As shown in the illustration (page 42), the roots of the peach stock on which the prune was grafted reach below a depth of eight feet, and the fine rootlets were found below the fourth foot, which would perhaps account for the sudden decrease in the moisture percentage that was observed at the sixth foot.

Walnuts.

Ventura County.—There are a number of walnut orchards east of Ventura on the loamy soil of the Saticoy Plain. In one of these, belonging to B. W. Dudley, the land is plowed deep every two years, a good cultivation being given each year. The trees were looking healthy when visited September 10th.

In another orchard not far from this, and belonging to H. W. Gibson, the trees were also in a healthy condition. The land is not plowed deep, but only well cultivated.

Santa Barbara County.—In Sisquoc Valley, and one mile east of Gary, walnut trees were growing in a black loamy soil, and seemed very healthy on September 16th. Cultivation was only three inches.

Soil.	Locality.	County.	Condition of Trees.	Moisture in Four Feet. Percentage. Total.	Hygroscopic.	Free.	Tons per Acre—Free.
Sandy loam	Saticoy Plain, Ventura; plowed deep.	Ventura	Good	9.3	5.5	3.8	304
Sandy loam	Saticoy Plain, Ventura; cultivated	Ventura	Good	8.3	5.5	2.8	224
Black loam	Sisquoc Valley, Gary	Santa Barbara	Good	5.5	3.1	2.4	192

It is evident from the above that the walnut will grow and live fairly well in loam soils having as low as 3 per cent of free water. Had they sent their feeding roots to a lower depth than three feet in the Sisquoc Valley soil they would doubtless have suffered, for there seems to have been no free water present below that depth.

GENERAL SUMMARY OF RESULTS.

The conclusions drawn from the results of the examinations, while some are tentative in that they need verification, are interesting and valuable; a general summary is given below. The amount of water in the lands of the several regions of the State was usually very low, and in many cases was below that naturally absorbed from a moist atmosphere alone. The following table is made to show the *highest* percentages in the several classes of soil in each agricultural region of the State, as far as ascertained in our investigations. The figures represent average percentages in four feet depth. Besides the percentages, we give the estimated amount of *free moisture*, or that over and above that in the hygroscopic condition.

MAXIMUM PERCENTAGES OF MOISTURE, IN THE SOILS OF THE VARIOUS LOCALITIES.

Sierra Foothills.

Soil.	Locality.	County.	Total Moisture.	Free Moisture.
Clay loam	Experiment Station	Amador	15.4	9.7
Sandy loam	Experiment Station	Amador	9.0	3.1

Average of 10 soils of foothills, 9.7 per cent, or 2.6 per cent of free water.

Sacramento Valley.

Soil.	Locality.	County.	Total Moisture.	Free Moisture.
Loam	West of Woodland	Yolo	18.8	8.8
Alluvial loam	Davisville	Yolo	15.5	5.5
Alluvial loam	Yolo orchard	Yolo	11.2	2.2
Sandy loam	Swingle	Yolo	10.1	4.1
Sandy	East of Davisville	Yolo	10.8	8.8

Average of 23 soils of Sacramento Valley, 9.7 per cent, or 2.8 per cent of free water.

San Joaquin Valley.

Soil.	Locality.	County.	Total Moisture.	Free Moisture.
Alkali loam	Tulare	Tulare	15.9	10.1
Black clay	West of Tulare	Tulare	14.1	4.1
Loam	Tulare	Tulare	11.9	9.2
Sandy	Modesto	Stanislaus	2.6	1.5

Average of 19 soils of San Joaquin Valley, 8.2 per cent, or 4.4 per cent of free water.

Coast Range Region.

Soil.	Locality.	County.	Total Moisture.	Free Moisture.
Clay soil	Arroyo Grande Valley	San Luis Obispo	19.1	8.8
Adobe	Talcoa Vineyard	Napa	18.2	4.5
Black adobe	West Berkeley	Alameda	16.9	6.9
Black clay	Paso Robles	San Luis Obispo	16.1	5.0
Black adobe	Pajaro	Monterey	14.6	5.6
Black adobe	Mission San José	Alameda	13.2	3.5
Sandy loam	Fort Romie	Monterey	8.7	5.5
Loam	Santa Maria	Santa Barbara	9.3	3.3
Loam	Campbells	Santa Clara	8.2	2.4
Alluvial loam	Niles	Alameda	6.3	1.8
Sandy loam	Santa Maria	Santa Barbara	6.1	1.6
Black loam	Sisquoc	Santa Barbara	5.5	1.0
Sandy soil	Nipomo Mesa	San Luis Obispo	1.8	.4

Average of 44 soils of Coast Range, 9.3 per cent, or 3.2 per cent of free water.

Southern California.

Moist loam	Experiment Station	San Bernardino	26.7	20.9
Black clay loam	Oxnard	Ventura	12.4	5.8
Silty loam	Saticoy Plain	Ventura	9.3	3.8
Sandy loam	Experiment Station	San Bernardino	6.2	4.2
Sandy soil	Fernando	Los Angeles	3.9	1.4

Average of 26 soils of Southern California, 6.8 per cent, or 2.6 per cent of free water.

It will be seen that the highest amount of water in soils examined was 26.7 per cent in the moist loam lands of Chino, and the next 19.1 per cent in the clay land of Arroyo Grande.

The clay soils and the alkali soil of Tulare all have high percentages, while the sandy lands are low in moisture content.

In computing general averages by agricultural regions we find the following result:

	Percentage.	
	Total.	Free.
Foothills ....10 soils	9.7	2.6
Sacramento Valley ..23 soils	9.7	2.8
San Joaquin Valley..19 soils	8.2	4.4
Coast Range ....44 soils	9.3	3.2
Southern California..26 soils	6.8	2.6
For State at large...121 soils	8.7	3.1

The northern part of the State, embracing Sacramento Valley and the foothills, with larger rainfall, had the highest averages of total moisture left in the soil; but this seems to be due to the greater hygroscopic power of the land, for the percentage of free water was much lower than that of the San Joaquin Valley and about that of Southern California.

The Coast Range, with fogs and cooler climate (and hence a less loss from evaporation) than the San Joaquin Valley, had more of total moisture than the latter; but here again the large percentage is due to the heavy clayey nature of its soils, which have a high hygroscopic coefficient; and when this is deducted the amount of free water is much less than in the San Joaquin Valley. The Foothills, and Southern California with its scant rainfall, had the lowest free water.

Relative Demands for Moisture on the Part of the Various Cultures.—The fact has been repeatedly shown in the foregoing pages that in soils of different textures the amount of water necessary for cultures is greater as the amount of clay in the soil increases, because of the greater retentive character of clay, and because of the restricted area from which plant roots are compelled to draw moisture and food. We thus find, that while an apricot tree will do well with 2 per cent of moisture in a sandy soil (or even eight tenths of one per cent in sand), it requires four times 2 per cent in an adobe; and the same is true with other cultures.

The following table is arranged to show the relative demands for total moisture on the part of various crops, and in the several characters of soil. The first column gives minimum of total moisture in which they did fairly well, while the other presents the maximum of moisture in which they were found to be suffering. Thus in sandy loam soils apricot trees were doing well with from 5 to 6 per cent of total moisture, while they were found to be suffering when the amount was 4 to 5 per cent.

Percentage.	Tons per Acre in 4 Feet.	Minimum Amount of Moisture in Which Cultures Did Well.	Maximum Amount of Moisture in Which Cultures Suffered.
		Sandy Soils—Hygroscopic Moisture 1–3.	
2.0	160	Apricots, Saltbush	Olives, Peaches, Plums, Grapes.
2.5	200	Olives, Peaches, Wheat	Cherries, Pears.
3.5	280		Citrus, Prunes.
		Sandy Loam Soils—Hygroscopic Moisture 3–5.	
4– 5	400	Saltbush	Apricots.
5– 6	480	Apricots	
6– 7	560		Prunes.
7– 8	640	Almonds, Plums	
8– 9	720	Apples, Olives, Peaches, Walnuts	
		Loam Soils—Hygroscopic Moisture 5.	
4– 5	400	Saltbush	Apricots, Almonds.
5– 6	480	Apricots, Citrus, Figs, Walnuts	
6– 7	560	Prunes, Grapes	Prunes.
7– 8	640	Plums	
8– 9	720	Apples	Almonds.
9–10	800	Almonds	
		Clay Loams—Hygroscopic Moisture 5–7.	
6– 7	560		Peaches, Plums.
7– 8	640		Wheat.
8– 9	720	Peaches, Grapes	Sugar Beets.
		Clay Soils—Hyroscopic Moisture 7–10.	
8– 9	720	Apricots	Figs.
9–10	800	Grapes	
10–11	880		Wheat.
11–12	960		Citrus.
12–14	112	Corn, Sugar Beets	

The absence of a culture from a group simply indicates that it had not been found growing upon that particular soil.

While the above table is interesting and useful in indicating the *total* amount of water required continually by crops on the various soils, and that as the soil increases in clayeyness the amount increases because of

the attraction for water on the part of the clay (hygroscopic), it is not a guide in determining the actual amounts required for particular cultures. This is found by eliminating the hygroscopic moisture and ascertaining the amount of *free water* present in soils where cultures grew and where they suffered, and comparing the results. This is shown in the following table, from which are omitted all determinations where no free water existed, as cultures very naturally suffered under such conditions, though maintaining life:

Free Water in 4 Feet Soil.		Cultures Doing Well in Minimum of Free Water.	Cultures Suffering in Maximum of Free Water.
Percentage.	Tons per Acre.		
0–1	80	Apricots, Olives, Peaches, Soya Bean	Citrus, Pears, Plums, Acacia.
1–1.5	120	Citrus, Figs	Almonds, Apples.
1.5–2	160	Almonds, Plums, Saltbush	Barley.
2–2.5	200	Walnuts, Grapes, Eucalyptus	
2.5–3	240	Apples, Prunes	Prunes.
3 –4	322	Pears, Hairy Vetch	Wheat.
4 –5	400	Wheat, Corn	
5 –6	480	Sugar Beets, Sorghum	Sugar Beets.

The above summary indicates that the apricot, olive, and peach do well on less water than other orchard fruits, one per cent of free water being sufficient if constantly present. With this amount the citrus fruits, pears, and plums were found to suffer, though the citrus trees were in good condition with a little more water. The almond seems to require about twice the water that the apricot does, while the prune was found to suffer with three times the water in which the apricot was flourishing.

Emphasis should be placed on the fact that this free water should be present throughout the soil to the depth of four feet at least, and especially around the feeding rootlets of the tree. The surface of the soil may be wet, and yet the tree may suffer if the ground below be so dry that the rootlets are not able to draw sufficient moisture. This drying-out of the under-soil is one of the evil effects of a severely dry season, and unless the rainfall of the succeeding winter be sufficient to penetrate to the depth of several feet and moisten the soil around the rootlets the trees will suffer almost as if no rain had fallen.*

The same is true with regard to irrigation; those who have to resort to the artificial application of water to their lands because of insufficient rainfall, should so apply it that it may reach the tree rootlets at the depth of several feet below the surface. This is too often not done, and examination will show that the water has, even after two days' irrigation with running water in furrows, not soaked down more than ten or twelve inches, if that much. The percolation of water downward varies according to the nature of the soil; in clayey soils it is extremely slow, our experiments showing that when water stands upon the surface of a loose, well-tilled loamy soil it soaks down about fifteen

* The dropping of fruit, so widely reported in 1900, was manifestly due to the exhaustion of moisture in the lower subsoil layers below a depth of five or six feet, from which the moisture needed for the filling out of the fruit before maturing, is usually derived. This has been especially notable in the small size of the fruit in the prune crop of Santa Clara Valley.—E. W. H.

inches the first twenty-four hours, about ten inches the next, and that percolation is slower and slower downward; but where the under-soil is compact the movement is but a few inches per day, if not almost arrested. It is then the emphatic duty on the part of the irrigator that he make examinations of the depth to which the water penetrates, and to regulate his methods accordingly.

The orchardist should bear in mind that the latter part of our dry summer seasons is very trying to the trees; the heavy loss of moisture caused by capillary rise from below to the surface and escape into the air, or by evaporation from the leaves of the tree, being drawn from the region of the rootlets below the surface, produces a drying-out of the soil and the almost entire exhaustion of all of the free moisture. Suffering naturally results on the part of the tree. Means should clearly be taken to prevent the excessive loss, and can in part be done by proper attention to surface conditions in the soil.

SOILS RECEIVED FOR EXAMINATION. 1897-1898.

Foothill Region.

Name.	Locality.	County.	Sender.
Micaceous soil	Rocklin	Placer	B. R. Woodworth.
Red soils (3)	Auburn	Placer	H. G. Guimares.
Red soils (4)	Jackson	Amador	J. D. Vanderbilt.
Red soil	Oroville	Butte	W. A. Beard.
Red soil	Palermo	Butte	W. W. Gillett.
Soil	Gazelle	Siskiyou	C. C. Webb.

Great Valley Region.

Name.	Locality.	County.	Sender.
Vegetable mold	Castle Crag	Shasta	A. H. Green.
Red soil	Redding	Shasta	C. Ehrenfield.
Loams	Redding	Shasta	Dr. C. Klinberg.
Yellow soil	Orland	Glenn	R. J. Trumbull.
Red soils (3)	Colusa	Colusa	S. V. West.
Red soil	Rumsey	Yolo	W. H. Mills.
Goose land soil		Yolo	— McIlrath.
Loam	Winters	Yolo	John Coop.
Tule soils	Pierson Rec. Tract	Sacramento	P. J. Van Loben Sels.
Soil	Walnut Grove	Sacramento	Sperry Dye.
Soils (16)	Galt	Sacramento	J. B. Duffy.
Tule soil	Stockton	San Joaquin	H. C. Shaw.
Red soil	Fresno	Fresno	G. A. Hare.
Soils (4)	Fresno	Fresno	D. T. Fowler.
Soils (6)	Fresno	Fresno	— Eggers.
Red soil	Mendota	Fresno	J. H. Hall.
Soils (5)	Mendota	Fresno	W. W. Holling.
Sandy soil	Modesto	Stanislaus	— Herron.
Soils (5)	Visalia	Tulare	A. D. Sweat.
Soil	Lindsay	Tulare	Sutton Palmer.
Clay loams (2)	Exeter	Tulare	G. T. Frost.
Soil	Bakersfield	Kern	D. E. Josephi.
Alkali	Rosamond	Kern	J. A. Stucky.
Alkali soils (3)			J. P. McCarthy.

Coast Range Region.

Name.	Locality.	County.	Sender.
Soil	Angwin	Napa	Dr. C. A. Buckel.
Soil	Petaluma	Sonoma	Theo. Skellman.
Dark soils (3)	Cazadero	Sonoma	H. Otis.
Loam soils (4)	San Pablo	Contra Costa	W. W. Holling.
Adobe	San Leandro	Alameda	E. B. Stone.
Adobe	San Leandro	Alameda	— McCarthy.
Soils	San Francisco	San Francisco	A. H. Weber.
Soils	San Francisco	San Francisco	G. C. Boardman.
Soils (6)	San Francisco	San Francisco	R. Oxnard.
Soils	San Francisco	San Francisco	A. Spreckels.
Dark soil	Half Moon Bay	San Mateo	Hans Jessen.
Dark clays (2)	Redwood City	San Mateo	A. S. Graham.
Soils (7)	Los Gatos	Santa Clara	G. A. Muirson.
Red soil	Saratoga	Santa Clara	P. H. Jordan.
Dark loams (3)	Santa Clara	Santa Clara	Mrs. S. Seerneth.
Dark loams (2)	Campbell	Santa Clara	F. E. Duncan.
Soils (4)	Morgan Hill	Santa Clara	W. W. Kelly.
Soils (4)	Morgan Hill	Santa Clara	B. E. Lane.
Soils (16)	Los Gatos	Santa Clara	Wm. Farwell.
Soils (2)	San José	Santa Clara	Wm. A. Cooper.
Soils (2)	San José	Santa Clara	O. B. Shaw.
Adobe (2)	San José	Santa Clara	T. D. McAdams.
Adobe (3)	Mountain View	Santa Clara	Mrs. C. Stevens Walter.
Soils	Martinez	Contra Costa	R. R. Veale.
Soil	Pacific Grove	Monterey	Dr. P. G. Dunninger.
Sandy soils (3)	Pomona	Los Angeles	M. C. Allen.
Sandy soils (2)	Los Angeles	Los Angeles	M. A. Tucker.
Soils (8)	Los Angeles	Los Angeles	Wm. Lyons.
Soils (2)	Los Angeles	Los Angeles	Dr. J. D. Moody.
Soils	Los Angeles	Los Angeles	J. S. Morrison.
Black sandy soils (2)	Artesia	Los Angeles	J. Paull.
Sandy loam	Clearwater	Los Angeles	C. P. Eldridge.
Soils (3)	Claremont	Los Angeles	J. A. Owens.
Red soils (5)	Riverside	Riverside	P. Hall.
Loam (4)	San Jacinto	Riverside	J. A. Cook.
Alkali soils (7)	Corona	Riverside	Dr. Hamilton.
Alkali soils (2)	Corona	Riverside	F. H. Sears.
Red micaceous soils (2)	Etiwanda	San Bernardino	G. A. Scanland.
Dark soils (6)	Cucamonga	San Bernardino	E. Firth.
Soils (4)	East Highlands	San Bernardino	Wm. M. Bristol.
Dark soils (7)	Westminster	Orange	S. J. Murdock.
Soils (3)	San Diego	San Diego	J. D. Jamison.
Black clays (2)	San Diego	San Diego	H. J. Rood.
Red soils (3)	Escondido	San Diego	A. W. Wohlford.
Red soils (4)	Otay	San Diego	F. H. Downs.
Soils (6)	Chula Vista	San Diego	H. Copeland.
Soils (15)	Miramar	San Diego	W. A. Scripps.
Soils	Nestor	San Diego	C. K. Stewart.

MINERALS, ROCKS, PLANTS, ETC., RECEIVED FOR EXAMINATION.

Article	Sender.	Address.	County.
Ext. Laurel Leaves	H. Cordes	Alameda	Alameda.
Eucalyptus Oil	H. Cordes	Alameda	Alameda.
Cypress Branches	J. M. Robinson	East Oakland	Alameda.
Lignite	H. C. Babcock	Temescal	Alameda.
Olive Branches	G. E. Springer	Oroville	Butte.
Wild Cherries	Mrs. C. H. Leggett	Oroville	Butte.
Quartz	C. F. Harkrader	Arbuckle	Colusa.
Pomace	John Smith	Martinez	Contra Costa.
Grape Juice	Mt. Diablo Wine Co.	Clayton	Contra Costa.
Marlstone	L. Grunaur	Brentwood	Contra Costa.

MINERALS, ROCKS, PLANTS, ETC., RECEIVED FOR EXAMINATION—Continued.

Article.	Sender.	Address.	County.
Gypseous Limestone	J. A. McClung	Selma	Fresno.
Coco Grass	Thomas Yost	Kings River	Fresno.
Limestones (2)	Wm. Ayres	Eureka	Humboldt.
Clay	T. J. Richards	Bishop	Inyo.
Turpentine Bush	A. A. Still	Annette	Kern.
Pumice	D. L. Shipman	Randsburg	Kern.
Sandstone	D. L. Shipman	Rosamond	Kern.
Infusorial Earth	J. S. Drury	Bakersfield	Kern.
Garnet	J. S. Drury	Bakersfield	Kern.
Eucalyptus Honey	J. H. Barber	Santa Monica	Los Angeles.
Roots of Various Plants	J. J. Rivers	Santa Monica	Los Angeles.
Olive Brine	Jas. Hall & Son	Los Angeles	Los Angeles.
Salt	Dr. N. A. Young	Los Angeles	Los Angeles.
Fuller's Earth	W. H. Dillon	Los Angeles	Los Angeles.
Clay	E. Basore	Pasadena	Los Angeles.
Pyrite	J. W. Depps	Pasadena	Los Angeles.
Siliceous Limestone	D. McFarland	Los Angeles	Los Angeles.
Claystone	Mining & Invest. Co.	Los Angeles	Los Angeles.
Iron Pyrite	J. C. Bailey	Willits	Mendocino.
Soapstone	A. G. High	Parkfield	Monterey.
Cassava Melon	J. W. Adams	Calistoga	Napa.
Meligan	H. W. Crabb	Oakville	Napa.
Hevlanite	E. A. Honey	Orange	Orange.
Marlstone	J. Hornbeck	San Jacinto	Riverside.
Yerba Mansa	J. A. Cook	Riverside	Riverside.
Oranges and Olives	J. A. Cook	Riverside	Riverside.
Orange Wines	J. A. Cook	Riverside	Riverside.
Sterilized Potato	M. S. Wahrhaftig	Sacramento	Sacramento.
Cans	Sacramento Fruit Co.	Sacramento	Sacramento.
Tanning Extracts	J. H. Caruthers	Rialto	San Bernardino.
Garnet Rock	M. Matheson	Victor	San Bernardino.
Infusorial Earth	W. P. McIntosh	Redlands	San Bernardino.
Reservoir Sediment	E. T. Mapel	Craftonville	San Bernardino.
Infusorial Earth	H. Earlcliff	Santa Barbara	Santa Barbara.
Rock Specimens	E. S. Machado	Morgan Hill	Santa Clara.
Marl	S. F. Graham	San José	Santa Clara.
Sandrock	E. E. Rupert	West Side	Santa Clara.
Limestone	J. W. Taylor	Los Gatos	Santa Clara.
Tannery Lime	E. C. McDonald	Aptos	Santa Cruz.
Marl	G. P. Hall	San Diego	San Diego.
Quartz	D. B. MacIver	San Diego	San Diego.
Beer	W. R. Blake	Escondido	San Diego.
Sandstone	E. F. Goodyear	San Francisco	San Francisco.
Gypseous Clay	E. Stamper	San Francisco	San Francisco.
Infusorial Earth	E. A. Denicke	San Francisco	San Francisco.
Marble	Geo. A. Moore	San Francisco	San Francisco.
Prunes	B. U. Rowley	San Francisco	San Francisco.
Paris Green		San Francisco	San Francisco.
Canned Apricots	J. F. Evans	San Francisco	San Francisco.
Olive Oil	Mr. Gugenhieme	San Francisco	San Francisco.
Dried Vegetables	Castle Bros.	San Francisco	San Francisco.
Wine Samples	Schlesinger & Bender	San Francisco	San Francisco.
Fiber	Mrs. Glaser	San Francisco	San Francisco.
Olive Oil	J. A. Filcher	San Francisco	San Francisco.
Peat	A. H. Green	Castle Crag	Shasta.
Claystone	A. L. Nixon	Anderson	Shasta.
Gypseous Brick	E. T. Mapel	Stockton	San Joaquin.
Clay and Sand	E. T. Mapel	Stockton	San Joaquin.
Marly Sand	Henry Tarr	Gubserville	Sonoma.
Pyrite	T. E. Dowd	Lakeville	Sonoma.
Cherry Tree	Mrs. A. C. Boyes	Sonoma	Sonoma.
Impure Limestone	B. F. Bowbeer	Penn Grove	Sonoma.
Root Sample	Mrs. Kate Martel	Vacaville	Solano.
Orange Branches	Mrs. Kate Martel	Vacaville	Solano.
Milk	E. W. Huston	Newman	Stanislaus.
Tree Branches	Adolph Osen	Corning	Tehama.
Marl	J. H. McFarland	Porterville	Tulare.
Infusorial Earth	H. Kelsey	Montalvo	Ventura.
Sandstone	J. J. F. C. De Seille		Texas.
Claystone	J. J. F. C. De Seille		Texas.

2. ALKALI AND ALKALI SOILS.

EFFECT OF ALKALI ON CITRUS TREES.

By R. H. Loughridge.

The orange orchards of Corona, Riverside County, are situated in the valley of Temescal Creek, which occupies a portion of the orange belt that encircles the San Bernardino Valley, and at an elevation of many feet above it. It is therefore above the alkali region of the valley, and its soils, mostly light, sandy, or silty loams, are well drained not only by the natural slope to the north and northeast, but also by a gravel bed at a depth of eight to ten feet beneath the surface. A general examination of the lands and water-supply of this region was made by Professor Hilgard in 1889 and published in the Station Report for 1890, pp. 42–46. The lands are well supplied with available mineral plant-food, as shown in the description and analyses given in that report on page 45.

"The salient point in the composition of all these soils is their high content of *potash*, exceeding one per cent in three cases in the Corona tract. * * * Lime also is in ample supply in all the soils. * * * Phosphoric acid likewise is in good supply in all and will not need supplementing for a number of years, since an unusually large proportion is in the soluble condition. The supply of humus, or vegetable matter (and with it that important substance, nitrogen), is unexpectedly large for mesa soils, and is at least adequate."

The soils are therefore well adapted to citrus culture, and with an abundant supply of good water, and proper irrigation facilities, the orchards should for very many years continue in a maximum flourishing condition. Upon the establishment of the colony the water-supply for irrigation was first drawn mainly from artesian wells and the normal flow of Temescal Creek, connected with the entire pipe-line system. Subsequently, as cultivation extended and these sources of water became inadequate, the lower portion of the orchard region received the water of Lake Elsinore.

The water of the artesian wells has been quite free from alkali salts, as shown by the analysis given below; while on the contrary, that of Lake Elsinore, originally received from the San Jacinto River, is always charged with alkali salts as shown in the table, the average being about 100 grains per gallon.

The use of the Lake Elsinore water was unfortunate for the orchards, for in 1898, after about four years of application to the lands, the trees began to suffer badly, losing both fruit and leaves to a large extent; while those under the artesian system were mostly in fine condition.

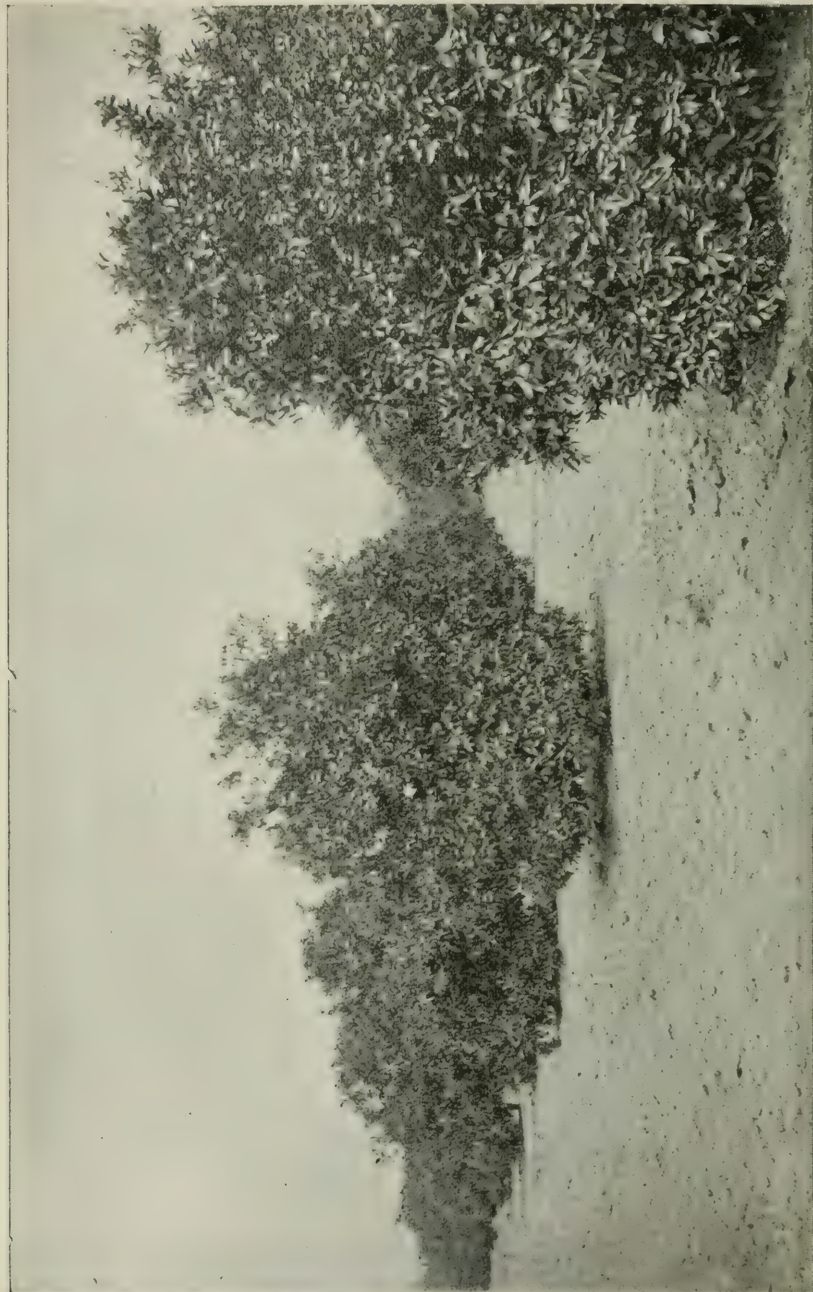


PLATE 15. Orange Trees Irrigated with Artesian Water, Corona.
Alkali in 4 feet of soil = 2,560 pounds per acre, chiefly sulfate of soda.

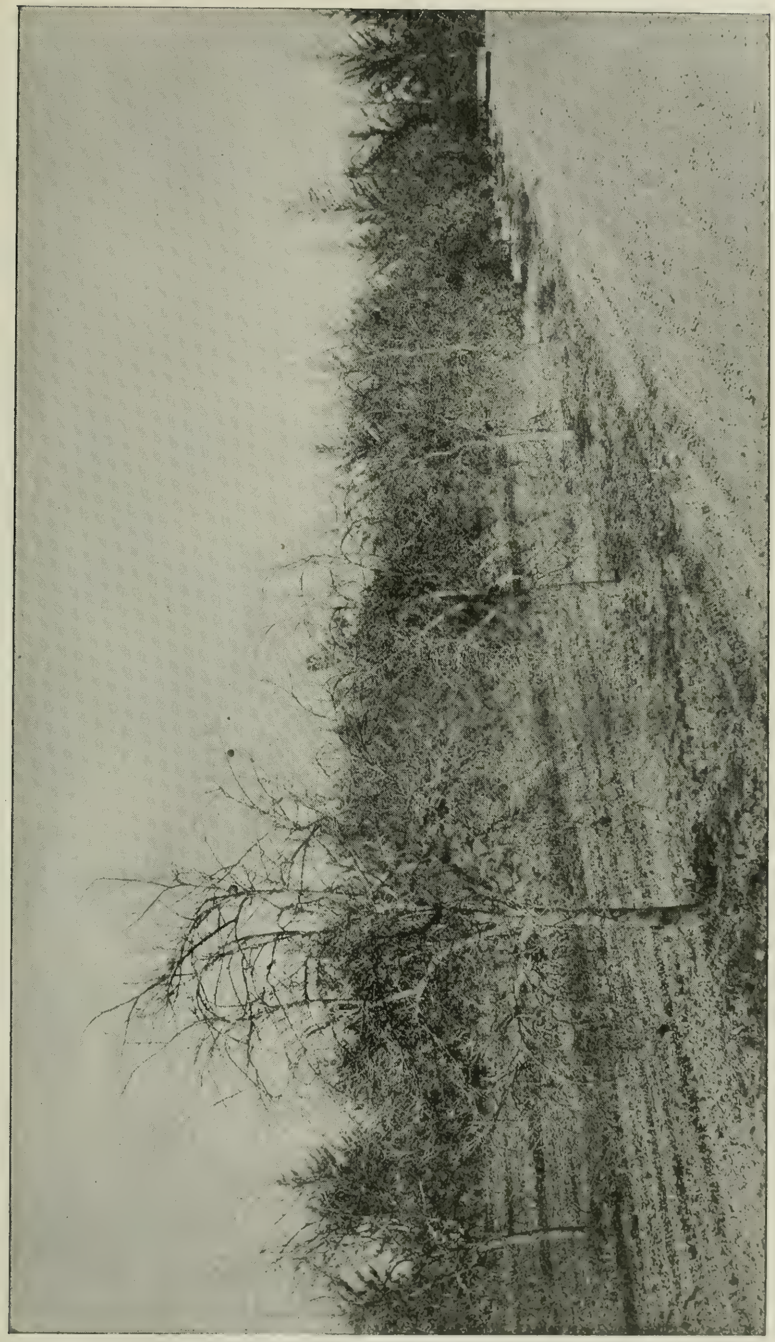


PLATE 16. Orange Trees Irrigated 3 Years with Lake Elsinore Water, Corona.
Alkali in 4 feet of soil = sulfates 4,720, carbonate 1,680, chlorid 2,520 pounds per acre, or a total of 10,920 pounds per acre.

The accompanying photographs (Plates 15 and 16) were taken in the Corona orchards, the one irrigated with the water of the artesian or upper-line system, the other with the Lake Elsinore or lower-line water.

Samples of the waters of the lake and the artesian supplies were taken in June, 1898; the former from the flume before reaching the orchards, while the latter was from the hydrant at the office of the water company. For comparison, the results of examination of the lake water of previous years are also given in the table. (See Station Report for 1890, p. 52.)

	Lake Elsinore.				Artesian.
	Grains per Gallon.				
	1890.	1891.	1897.	1898.	1898.
Total residue by evaporation	103.21	84.34	98.42	116.18	16.23
Soluble in water after evaporation	95.21	71.84	88.20	98.54	9.46
Insoluble in water after evaporation	2.75	5.96	5.84	9.46	4.32
Organic matter and chemically combined water	5.25	6.54	4.38	8.18	2.45
The Soluble Part consists of					
Sodium and potassium sulfates (glauber salt, etc.)	76.00	14 85	20.11	22.03	6.97
Sodium chlorid (common salt)	19.21	43.37	47.05	53.62	.64
Sodium carbonate (sal soda)		13.62	21.04	22.89	1.85
The Insoluble Part consists of					
Calcium and magnesium carbonates; calcium sulfate (gypsum)	2.75	5.49	4.96	7.01	3.80
Silica	Trace.	.47	.88	2.45	.52

The water of the lake, which is fed by the very variable flow of the San Jacinto River, seems to have become more concentrated in the twelve months that elapsed after the sample of 1897 was taken, for there are increased amounts of the alkali salts.

The difference in the character of the lake and the artesian waters is also well shown in the table, especially in the soluble portion or alkali proper of the salts; in the lake water we find ten times more than in the Artesian. The proportion of common salt in the two waters is about 90 to 1, and of the carbonate nearly 12 to 1.

At the request of the orchardists and the water company, the Station made examination of the orchard soils, with a view of ascertaining whether the suffering on the part of the trees was due to the presence and effect of the alkali or to some other cause. A number of the most prominent orchards were visited and samples of soil taken to a depth of several feet from near trees that were in the worst condition and from near those that were looking better. Orchards under the Elsinore and also under the Artesian irrigation system were examined. In all there were fifty-five samples taken for alkali examination. The results of the examination are given below, the orchards being designated by letters only.

Orchard trees may suffer from each of several causes or a combination of causes in the soil, aside from disease and insects; and in any examination made to ascertain the reasons why trees suffer or show signs of distress, all of these must be kept in view.

Several conditions, both physical and chemical, are necessary for full vigor and productiveness in trees; which may be briefly summarized as follows:

1. The soil should be deep, at least five feet, to allow of the deep penetration of the tree roots in search of moisture and food. The depth may unfortunately be limited by bedrock, by thick beds of pure sand or gravel, by hardpan, by bottom water, or by shallow irrigation.

2. The soil should be well aërated, in order that the roots may secure sufficient air for life. It is known that at least one half of the spaces between the soil grains should be occupied by air.

3. The soil should contain sufficient moisture to supply the roots continually. In a loam having a maximum water-capacity of about 30 per cent, there should never be less than 8 per cent nor more than 15 per cent. In a heavy clay, more is required, as the soil withholds about 10 per cent from absorption by the roots.

4. The soil should be well drained, to carry off the surplus water and permit the circulation of air; otherwise the roots will be "drowned out."

5. The soil should be warm enough for the germination of seed, for easy movement of moisture into the tree, and for growth and vigor in the tree.

6. The soil should contain sufficient amounts of available plant-food, chiefly potash, phosphoric acid, nitrogen, and lime.

7. The surface foot of soil should be well supplied with humus, or decayed vegetable matter, which acts as the reservoir of organic nitrogen and of nitrifying bacterial organisms.

8. Lime should be abundant in the soil to neutralize the soil-acids, and to favor nitrification.

9. The soil should be free from an excess of soluble salts, or what is known as alkali, either "black" or "white"; for either the growth of the tree or its fruiting qualities will be injuriously affected by them.

The first of these conditions is too often overlooked by the farmer in the selection of land for orchards; and while the young trees may flourish for a few years in a soil having a depth of but two or three feet, the time soon comes when the roots will fail to perform their functions of sending moisture and food to the leaves, and the latter will wilt, turn yellow, and fall. This shallowness of the soil, whether because of an understratum of rock, gravel, or sand, or of water, has been found to be the cause of many of the failures or suffering on the part of orchard trees in this State; and therefore whenever signs of distress appear in trees, the orchardist should immediately ascertain the physical conditions of the land to a depth of four or five feet, before concluding that fertilization is needed.

In the Corona orchards several of these adverse conditions were found to exist, and it thus became somewhat difficult to determine to which the suffering on the part of the tree was chiefly due. The fact that only the orchards irrigated with the Elsinore water were in this condition indicated at once that the alkali of that lake water was chiefly responsible, either by directly injuring the trees, or by producing harmful physical conditions in the land, such as compacting the subsoil into an impervious hardpan. The various faults in the land, as observed in the examination, are briefly presented below.

A general difference between the orchards under the two irrigation systems was noted: those under the purer artesian water having thrifty trees, with more, larger, and greener leaves, and scarcely any shedding of foliage. The trees under the alkali water of Elsinore had lost a large part of their leaves, especially the larger ones; those remaining being

mostly small and sickly. Some of the orchards under Elsinore water were afflicted worse than others, because of additional physical causes in the soils.

PHYSICAL CONDITIONS IN THE ORCHARDS.

Shallow Soils.—In two orchards, one under the Elsinore and the other under the Artesian supply and belonging to the same firm, it was found that the soil was underlaid at three feet by quite a compact bed of broken rock, so compact as evidently to interfere with proper penetration of the root-system; and hence productive of more or less injury to the trees. Both fruit and leaves were rapidly falling off, but the effect was most severe in the lower orchard, irrigated with Elsinore water.

To this shallowness in the soil could be ascribed much of the suffering on the part of the trees common to both orchards.

Methods of Cultivation.—In a number of orchards examination showed a lack of proper cultivation; and to this may be attributed some of the extreme suffering on the part of the trees. The method followed was that of merely stirring the soil year after year to a depth of a few inches; which, with the aid of the alkali, has resulted in the formation of a plowsole hardpan, which not only prevented the proper aëration of the soil, but also the percolation of water to the deeper roots of the tree; it also caused much waste of water by run-off from the surface.

Deep plowing should have been given the orchards once a year, in order to so loosen the soil as to avoid the above evils. In contrast to the condition of these orchards was that of an orchard in the western part of the colony, and also under the Elsinore system, in which deep and thorough cultivation was maintained; it gave to the soil a more mellow character and to the trees better leafage, though the latter were falling rather severely.

MOISTURE SUPPLY IN THE SOIL.

The method of irrigation practiced in these orchards is that of two or more shallow furrows midway between the trees and in the direction of the slope of the land only. Water was allowed to flow from the ditch down these furrows for two days and then the supply was cut off. As a consequence much of the water reached the lower portion of the orchard and was lost; the water in the furrows failed to soak deeply into the soil, or far enough to either side to reach the intermediate roots. Especially was this the case in those orchards where shallow cultivation of the soil permitted the hardpan to form.

An examination of the soil by Mr. Mills, foreman of the Southern California Experiment Station, showed that a two days' irrigation had wetted the soil to a depth of from twelve to eighteen inches only, and about the same on either side of the furrow.

The sloping character of the land thus permits of the escape of much water that is not readily received by the soil, and this amount is large, owing to the slow percolation.

This loss could be largely prevented if means were taken to hold the water upon the land until it could find its way downward, as by the *cross-furrow basin system* around the trees. This is best done by running a deep cross furrow on each of the trees at a distance of three or

four feet from the trunk, throwing the soil outward to form an embankment. With a hoe the proper points may be closed, thus forming a continuous ditch around the tree into which water may be admitted from a central furrow and allowed to soak into the soil. When a sufficient amount is given, the soil must be thrown back over the wet surface, thus preventing loss from evaporation and rendering subsequent tillage of the land unnecessary. In this way the percolation would doubtless be more rapid, because the water could follow the roots.

The advantages of this system of irrigation, properly practiced, are several:

1. The conservation of water when the supply is not large; for the basin would hold the water and allow it time to soak into the soil. There would of course be evaporation of moisture into the air from the surface of the water, but this would not equal the loss by the same evaporation in the furrow and the run-off from the land.

2. The tree would secure a larger amount from the same supply; for the water would be delivered to the roots of the trees and on all sides of the trees, instead of at some distance from them and only on two sides.

3. The supply thus being greater and delivered to greater depths, the roots of the trees would penetrate deeper into the ground and out of reach of the heated and draughty soil surface.

4. The deep soaking of the soil around the tree with water, which would otherwise have been lost from the furrows, would make the necessity of irrigation less frequent, especially if the soil around the tree were kept in a loose condition to prevent the escape of moisture through capillary evaporation.

5. A relatively small amount of water so used will serve to leach out accumulated alkali salts into the subdrainage.

6. There will be conservation of expense as well as of moisture.

The difficulty with which water was found to have soaked into the soil led to the question whether the trees were suffering from a lack of sufficient supply. Mr. Mills, therefore, secured samples to the depth of six feet for moisture determinations. The results are given below:

MOISTURE IN THE SOILS OF IRRIGATED ORANGE GROVES.

	Irrigated with Elsinore Water. Trees in Poor Condition.								Irrigated with Artesian Water. Trees in Good Condition.	
	M. Two Months After Irrigation.		C. One Month After Irrigation.		L. Nine Days After Irrigation.		McC. Two Days After Irrigation.		B. Six Days After Irrigation.	
	Per Cent.	Tons per Acre.	Per Cent.	Tons per Acre.	Per Cent.	Tons per Acre.	Per Cent.	Tons per Acre.	Per Cent.	Tons per Acre.
First foot	10.0	200	7.1	142	15.7	314	30.0	600	6.1	122
Second foot	11.0	220	6.7	134	11.4	228	30.0	600	6.1	122
Third foot	9.0	180	6.9	138	10.3	206	6.0	120	6.7	134
Fourth foot	10.0	200	7.7	154	15.0	300	7.0	140	6.5	130
Fifth foot	11.0	220	8.5	140	14.8	296	......	......	8.5	170
Sixth foot	10.0	200	10.5	110	13.5	270	......	......	5.1	102
Total in 4 feet	10.0	800	7.1	568	13.1	1,048	18.3	1,460	6.3	508
Total in 6 feet	10.2	1,220	7.9	818	13.5	1,614	......	......	6.8	780

The first soil in the above series (M.) had had deep plowing and good cultivation, and in consequence had retained moisture much better at the end of two months than had C. at the end of one month after irrigation. In the latter much of the water applied had run off and failed to soak into the soil. The soil of L. had also retained a very large percentage of water, but the time that had elapsed since irrigation was shorter. The water in L. does not seem to have soaked rapidly into the soil, for the surface foot holds the largest percentage, though to only one half saturation.

The difficulty with which water penetrates these soils is shown in both McC. and B., for when the samples were taken the surface of the latter was still nearly saturated and in a mushy condition, even six days after irrigation.

Amount of Moisture Necessary for Citrus Trees.—The fact that the trees in the orchard of B. under the artesian water system flourished well with 6.3 per cent of total moisture (free water, 3.5 per cent) at their command indicates clearly that that amount constantly present for the use of the plant is sufficient in a soil of this character. Such is also the case with other orchard fruits, provided the soil be of a loamy character. In heavier clay lands the amount must be greater, for the clay is more stubbornly retentive of moisture, and in a clay soil roots have less freedom of movement.

Another lesson taught is that in irrigation districts where water is precious, it is a waste to add much more water when the amount already present is largely in excess of that required, viz: 6 per cent in this case. The maximum water capacity of the Corona soils is about 56. But only one half this percentage should be present at once, for the roots must have air as well as moisture. Therefore in a case (as L.) of the above it would be useless to add more until the percentage were lowered. The trees of most of the orchards were clearly not suffering from lack of sufficient moisture when visited.

ALKALI IN LANDS OF CORONA.

In passing over the land no alkali was observed as white or black deposit except near leaky pipes, and thus to all appearances none was present, probably because of cultivation of the soil.

Alkali in Unirrigated Soil.—In order to ascertain whether or not the unirrigated lands outside of the orange tracts naturally contained any alkali salts, samples were taken from two localities and examined; the results agree with those of other lands of the State lying above alkali valleys, and heretofore supposed to have lost their soluble salts by natural drainage. One of the samples was an average of the upper foot of soil, while the others were representative of each foot to the depth of three feet. The figures in these tables, as well as in those to follow, represent percentages in the soil, and also, for convenience in discussion, average pounds per acre.

ALKALI IN UNIRRIGATED LAND.

	Percentage in Soil.				Pounds Per Acre.			
	Alkali Sulfates....	Carbonate of Soda.....	Chlorid of Sodium....	Total Alkali.	Alkali Sulfates.....	Carbonate of Soda.....	Chlorid of Sodium....	Total Alkali.
First Field—								
First foot............	.010	.000	.000	.010	400	0	0	400
Second Field—								
First foot............	.009	.000	.000	.009	360	0	0	360
Second foot...........	.012	.000	.000	.012	480	0	0	480
Third foot............	.010	.000	.000	.010	400	0	0	400
Total in 3 feet......	.010	.000	.000	.010	1,240	0	0	1,240

The average amount for the first or upper foot in each locality was practically the same. The entire absence of carbonates and chlorids of sodium will also be noted, thus leaving the sulfate, or glauber salt, as the only saline ingredient in these natural lands; and which in such small amount is wholly insufficient to cause any injury.

Alkali in Soil Irrigated from the Artesian and Elsinore Systems, respectively.—The water from the artesian wells contains some alkali salts as shown above, but the amount is very small when compared to that of Lake Elsinore. There might, of course, be an accumulation of alkali in soils in which it is used, if applied sparingly; but very many years would be required to make it so great as to be hurtful to vegetation, especially so as there is very little carbonate and chlorid of sodium present. The water from the lake, however, with its 100 grains per gallon, and large proportion of common salt, would in the course of a few years give to the soil an injurious amount of alkali. From the analysis, it is estimated that a million gallons of the water soaking into an acre of land would carry with it about 14,000 pounds of alkali, comprising 3,270 pounds of carbonate of soda (black alkali), 7,660 pounds of chlorid of sodium (common salt), and 3,070 pounds of the sulfate (glauber salt). This amount of water would cover the land to a depth of 37 inches, and probably is what is given it in the course of three years' irrigation. On many of the Corona orchards, so much water is allowed to run off as waste that the soil does not receive this amount, and hence we find a smaller accumulation of the alkali.

In the following tables (which give the results of the leaching of the soils) it will be noticed that many of the orchards irrigated with the Elsinore water have a much less amount of carbonate of soda than we should anticipate from such an alkali source. This is explained by the fact that there is in much of this land, gypsum derived from the deposits in the bordering hills; and that much of the carbonate of soda in the water, coming in contact with this gypsum, has been changed into glauber salt, or sulfate of soda, and thus rendered far less injurious to trees.

ALKALI IN SOILS OF ORCHARDS IRRIGATED WITH ARTESIAN WATER.

	Percentage in Soil.				Pounds per Acre.			
	Alkali Sulfates	Carbonate of Soda	Chlorid of Sodium	Total.	Alkali Sulfates	Carbonate of Soda	Chlorid of Sodium	Total.
B. F. 36.								
First foot	.022	.000	.000	.022	880	0	0	880
Second foot	.023	.000	.000	.023	920	0	0	920
Third foot	.010	.000	.000	.010	400	0	0	400
Totals	.016	.000	.000	.016	2,200	0	0	2,200
B. F. 43.								
First foot	.008	.000	.000	.008	320	0	0	320
Second foot	.027	.000	.009	.036	1,080	0	360	1,440
Third foot	.014	.000	.000	.014	560	0	0	560
Fourth foot	.015	.000	.000	.015	600	0	0	600
Totals	.015	.000	.002	.017	2,560	0	360	2,920
D.								
First foot	.018	.008	.000	.026	720	320	0	1,040
Second foot	.001	.008	.009	.018	40	320	360	720
Third foot	.038	.000	.000	.038	1,520	0	0	1,520
Totals	.019	.005	.003	.027	2,280	640	360	3,240

ALKALI IN SOILS OF ORCHARDS IRRIGATED WITH ELSINORE WATER.

L. R. C.								
First foot	.059	.017	.009	.085	2,360	680	360	3,400
Second foot	.017	.017	.000	.034	680	680	0	1,360
Third foot	.028	.008	.009	.045	1,120	320	360	1,800
Totals	.034	.014	.006	.054	4,160	1,680	720	6,560
McC.								
One third more water than L. R. C.; trees 9 yrs, small leaves								
First foot	.013	.008	.009	.030	520	320	360	1,200
Second foot	.047	.017	.000	.064	1,880	680	0	2,560
Third foot	.012	.017	.027	.056	480	680	1,080	2,240
Fourth foot	.041	.008	.009	.058	1,640	320	360	2,320
Totals	.023	.012	.011	.052	4,520	2,000	1,800	8,320
D. L.								
Gravel at 3d foot.								
First foot	.020	.000	.018	.038	800	0	720	1,520
Second foot	.026	.000	.009	.035	1,040	0	360	1,400
Third foot	.019	.008	.009	.036	760	320	360	1,440
Totals	.021	.002	.012	.035	2,600	320	1,440	4,360

Alkali in Soils of Orchards Irrigated with Elsinore Water—Continued.

	Percentage in Soil.				Pounds Per Acre.			
	Alkali Sulfates	Carbonate of Soda	Chlorid of Sodium	Total.	Alkali Sulfates	Carbonate of Soda	Chlorid of Sodium	Total.
B. F. 36.								
Hardpan at 4th foot.								
First foot	.029	.017	.018	.064	1,160	680	720	2,560
Second foot	.007	.008	.036	.051	280	320	1,440	2,040
Third foot	.008	.017	.000	.025	320	680	0	1,000
Totals	.014	.014	.018	.046	1,760	1,680	2,160	5,600
B. F. 43.								
First foot	.012	.008	.018	.038	480	320	720	1,520
Second foot	.029	.008	.009	.046	1,160	320	360	1,840
Third foot	.016	.008	.000	.024	640	320	0	960
Fourth foot	.005	.008	.000	.013	200	320	0	520
Totals	.015	.008	.007	.030	2,480	1,280	1,080	4,840
K.								
First foot	.098	.017	.063	.178	3,920	680	2,520	7,120
Second foot	.053	.008	.090	.151	2,120	320	3,600	6,040
Third foot	.033	.017	.000	.050	1,320	680	0	2,000
Totals	.061	.014	.050	.125	7,360	1,680	6,120	15,160
S. W. L.								
Trees lost their leaves.								
First foot	.052	.008	.018	.078	2,080	320	720	3,120
Second foot	.043	.017	.045	.105	1,720	680	1,800	4,200
Third foot	.011	.017	.000	.028	440	680	0	1,120
Fourth foot	.012	.000	.000	.012	480	0	0	480
Totals	.029	.010	.015	.054	4,720	1,680	2,520	8,920
S. W. L.								
Trees look a little better.								
First foot	.058	.008	.009	.075	2,320	320	360	3,000
Second foot	.006	.026	.009	.041	240	1,040	360	1,640
Third foot	.026	.008	.000	.034	1,040	320	0	1,360
Fourth foot	.013	.017	.000	.030	520	680	0	1,200
Totals	.025	.015	.004	.045	4,120	2,360	720	7,200
J. F. M.								
Elsinore and Artesian water.								
First foot	.072	.008	.009	.089	2,880	320	360	3,560
Second foot	.029	.008	.000	.037	1,160	320	0	1,480
Third foot	.008	.000	.000	.008	320	0	0	320
Fourth foot	.008	.008	.009	.025	320	320	360	1,000
Totals	.029	.006	.004	.039	4,680	960	720	6,360
First foot	.035	.008	.009	.052	1,400	320	360	2,080
Second foot	.014	.008	.000	.022	560	320	0	880
Third foot	.008	.008	.000	.016	320	320	0	640
Fourth foot	.016	.008	.000	.024	640	320	0	960
Totals	.018	.008	.002	.028	2,920	1,280	360	4,560

ALKALI IN SOILS OF ORCHARDS IRRIGATED WITH ELSINORE WATER—Continued.

	Percentage in Soil.				Pounds Per Acre.			
	Alkali Sulfates	Carbonate of Soda	Chlorid of Sodium	Total.	Alkali Sulfates	Carbonate of Soda	Chlorid of Sodium	Total.
E. E. H.								
First foot	.191	.002	.206	399	7,640	80	8,240	15,960
E. S.								
First foot	.068	.008	.045	.121	2,720	320	1,800	4,840
BY IRRIGATING DITCHES.								
V. K.								
First foot	.112	.000	.099	.211	4,480	0	3,960	8,440
Second foot	.057	.000	.099	.156	2,280	0	3,960	6,240
Third foot	.064	.008	045	.117	2,560	320	1,800	4,680
Totals	.076	.003	.081	.160	9,320	320	9,720	19,360

It is not necessary to go into a detailed discussion of the above tables; and we will merely call attention to some of the more prominent features. The *first* is the difference in the amount of salts accumulated under the two irrigation systems. After three years use we find in a depth of three feet a maximum of 3,240 pounds of total salts per acre in the orchards irrigated with artesian water, and 15,160 pounds in those with the Elsinore alkali water, while in natural land there is but a total of about 1,250 pounds. In an orchard having the same character of soil and using the two systems of supply (B. F.) there was an accumulation of 5,600 pounds under one and 2,200 pounds under the other, the samples being taken at a distance of eight rows of trees from each other.

The character of the alkali is also worthy of note; under the Elsinore system there were maximum accumulations of 1,680 pounds of carbonate and 6,120 pounds of chlorid in three feet depth per acre, while under the artesian the amounts were 640 pounds of carbonate and 360 pounds of chlorid per acre. In the unirrigated lands neither of these two salts was found.

The *second* point of interest is the difference in the alkali accumulation in orchard lands under the same system of supply in the same length of time. These differences vary from a minimum of 3,600 pounds per acre in three feet of land under good cultivation, 4,360 to 8,440 pounds in orchards where the physical conditions seemed to prevent the free percolation of the water to lower depths, and a maximum of 15,160 pounds in an old orchard. These differences are due in part to variability in the water-absorption power of the soils of the several orchards, and in part to the smaller use of water by the owners.

The *third* point is that the relative proportions of the alkali ingredients, or the percentage composition, varies in the soils of the different orchards irrigated with the lake water, and differs from that of the alkali of the water itself; this is shown in the following table:

PERCENTAGE COMPOSITION OF ALKALI SALTS.

	Water.	J. E. M.	S. W. L.	L. R. C.	B. F.	D. L.	K.
Sulfates	22	74	53	63	30	60	49
Carbonates	24	16	19	26	30	35	40
Chlorids	54	10	28	11	40	5	11

It is interesting to note that while in the water the sulfates are in least proportion and the chlorids largest, in the soils the reverse is mostly true, there being but one exception shown in the above table. The proportion of carbonates is lower in some and greater in others than in the lake water. These differences are doubtless due to changes that have taken place in the soil because of the presence of gypsum and other minerals.

Alkali from Leaky Ditches.—In one of the orchards a white incrustation was observed by the side of an irrigating trough which connected the main flume with the minor ditches of the orchard and was used only when water was being put on the orchard. An examination of the soil at this point to a depth of three feet showed an accumulation of about 19,360 pounds of alkali per acre, of which one half was common salt, as in the lake water. This was of course local, but indicated what would happen had the leak been by the side of the main irrigation channel where water flows continuously. In this case the largest amount was naturally in the upper foot, for the water escaping from the ditch at any one time was hardly sufficient to carry it down far into the soil, and capillarity induced by surface evaporation of the water would tend to cause a rise of the alkali from below.

Effect of the Alkali upon the Citrus Trees.—The effect produced by the presence of alkali in the soil is both direct and indirect: direct in its action upon the trees through their roots, and indirect in its action upon the physical nature of the soil and hence through the soil upon the tree. The direct action varies with the nature of the alkali and, of course, with the amount in the soil. The *carbonate of soda* is regarded as the most dangerous of the alkali salts, because of its intense alkalinity and corrosive action on the rootlets of plants and trees; and it has been thought from numerous observations, that the largest amount tolerated by culture plants is 2,000 pounds in the upper three feet of soil. In the Corona orchards, whose trees were suffering, the amount did not reach this limit, except in two instances. In one of the orchards the amount of the sulfate and chlorid was too small to be seriously injurious, and here we found 960 pounds of the carbonate per acre in three feet of soil. The land was in excellent cultivation, and to no other cause than the carbonate could the falling of leaves and fruit be ascribed. The injury was not great, but it indicated the border-line of tolerance on the part of the trees. In no case were the trees thrifty when a larger amount of this carbonate was present.

The chief injurious effect of the *chlorid of sodium*, or *common salt*, upon plant life is that of an antiseptic whose action seems to be in the arrested development or killing of the nitrifying organisms in the soil.

It has been found that 400 pounds per acre-foot has prevented growth in a number of crops; and as these alkali soils of the Corona orchards have more than this amount there is but little doubt that much of the injury to the trees may be attributed to the common salt, preventing nitrogen nutrition. The trees under the Elsinore system that look the best are those which have the least common salt, though the reverse is not entirely true. Some of the orchards have an enormous amount, that of K. more than 6,000 pounds and of E. E. H. more than 8,000 pounds per acre.

Sulfate of soda, or *glauber salt*, is injurious when in large amounts, and as it is a neutral salt its action would seem to be chiefly that of preventing osmosis of the soil solution inward into the cells of the roots; this would naturally deprive the plant or the tree of sufficient nourishment for the maintenance of growth or vigor, and would finally produce death. As the amount of the sulfates in the Corona orchards falls far short of that tolerated by most crops, the suffering of the trees can hardly be attributed to the direct action of the sulfate alone.

Reclamation of the Injured Orchards.—It is at once apparent that the use of the alkali water of Lake Elsinore for irrigation purposes must cease, for the limit of tolerance of its alkali has already been passed in most of the orchards; a purer water must be brought upon the land.

The cause of suffering on the part of the trees must be removed, whether that cause be the direct effect of the alkali upon the roots, or the injurious physical condition of the soil brought about by the alkali.

In many of the affected orchards some relief can be had by bringing the soil back to its original excellent tilth by proper tillage, by deep plowing of the soil to break up the compact, hardpan condition into which it has come because of the alkali, and by carefully keeping it in the best physical condition so as to afford proper aëration and freedom of penetration of the roots of the trees, and above all for the proper freedom of downward percolation of water to depths of several feet.

As an aid to this loosening of the soil a green-manure crop should be grown and turned under to decay and give needed humus, which is an active agent in maintaining good tilth.

The benefits of attention to these conditions are well shown in the orchard of J. F. Meganson, where by deep plowing and cultivation the trees have been able to withstand the effects of the alkali to a better degree than elsewhere.

Then the alkali that has already accumulated to so large an extent in the soils must be removed from the region of the rootlets of the trees, if not from the entire land. This can only be done by *thorough leaching of the soil around the trees to depths of five or six feet* or, what is better, to the bed of gravel that underlies these lands. If the latter, then the alkali will be carried off into the lower lands through the gravel beds and there will be no further fear of damage from it. If, however, it is only carried down to lower depths in the soil, there will be a tendency to rise by capillarity not only with the water that carried it down, but also subsequently by any water that may reach it from abundant irrigation. Precautions must therefore be constantly taken to prevent this rise toward the surface, and this may be done by mulching the surface, i. e. loosening the soil by cultivation to a depth of six to eight inches, after each irrigation. The rule should be, that after

every irrigation the soil be well cultivated, which will not only prevent the rise of the alkali, but will also conserve the moisture, keeping it in the soil for the tree instead of letting it pass off into the air.

This leaching of the alkali downward should preferably be done by the artesian water; but in the absence of a sufficient amount the water of the lake could temporarily be used, provided that enough be used at once to soak to the gravel and to wash the alkali into the country drainage, otherwise it would only aggravate the evil. Should the leaching be thorough, then the alkali remaining would only be that corresponding to the amount of unconcentrated lake water retained in the soil. To facilitate this removal of the alkali and to prevent a waste of water, the system of irrigation mentioned above or one similar should be adopted for each tree; thus better insuring deep percolation.

EXAMINATION OF ALKALI SOILS SENT BY INDIVIDUALS.

By R. H. Loughridge.

Black Alkali Soils from the land of Hager & Tuttle, one mile north of Colusa, Colusa County. This tract is situated on the timbered valley plain about half a mile west from the Sacramento River. This is thus far the most northerly point at which black alkali has been observed in the Sacramento Valley. The samples were taken by F. H. Snow, on March 23d, to the depth of six feet.

	Percentage in Soil.				Average Pounds Per Acre.			
	Sulfates of Soda	Carbonate of Soda	Chlorid of Sodium	Total.	Sulfates of Soda	Carbonate of Soda	Chlorid of Sodium	Total.
First foot	.063	.153	trace	.216	1,260	3,060	traces	4,320
Second foot	.071	.153	"	.224	1,420	3,060	....	4,480
Third foot	.027	.017	"	.044	540	340	....	880
Fourth foot	.031	.009	"	.040	620	180	....	800
Fifth foot	.018	.034	"	.052	360	680	....	1,040
Sixth foot	.018	.004	"	.022	360	80	....	440
Total in six feet	.038	.061	"	.099	4,560	7,400	....	11,960

This alkali tract occupies but a very small area in the alluvial land bordering the river. The surface had a black incrustation from the humus that had been dissolved by the carbonate of soda.

As will be seen by the analysis, the carbonate, as well as most of the alkali, occurs in the upper two feet, so that its reclamation should be an easy matter. Gypsum applied at the rate of about six tons per acre, which for this small spot would amount to not more than fifty pounds, would be required to convert the carbonate into the sulfate.

A sample of the soil taken near this black alkali spot and examined, was found to contain no carbonate or chlorid of sodium, and the amount of glauber salt was comparatively small, as seen in the following figures:

	Per Cent.	Pounds Per Acre.
First foot	.018	360
Second foot	.021	420
Third foot	.029	580
Fourth foot	.011	220
Fifth foot	.007	140
Sixth foot	.004	80
In six feet	.015	1,800

The amount is not sufficient to injure the most delicate of crops or plants, and is but little more than naturally occurs in the arid region of the State.

Alkali Efflorescence, which is blown about by the wind over the grounds of the Experiment Station at Tulare. The sample sent was composed of

	Per Cent.
Dust, etc.	48.4
Sulfate of Soda	46.9
Carbonate of Soda	.4
Chlorid of Sodium	4.1
Gypsum	.4
Total	100.0

A few years ago the dust of the substation was strongly of black alkali, but the effects of the applications of gypsum to the lands show themselves in the extremely small amount of carbonate of soda. More than one half of the dust as scraped off of the ground was of alkali, and less than one half of one per cent was black alkali.

Alkali Water from the old and the new sumps, respectively, on the Experiment Station tract at Tulare. Taken April 6, 1898.

	Grains per Gallon.	
	Old Sump.	New Sump.
Sulfate of Soda	104.6	19.9
Carbonate of Soda	33.3	10.0
Chlorid of Sodium	31.5	5.3
Total grains per gallon	169.4	35.2

The old sump had been for years the recipient of drainage waters from the adjoining alkali lands, and from it they escaped to underground channels. Since the reclamation of these lands by gypsum and the conversion of the carbonates to sulfates, the drainage water has of course been also changing, and while highly charged with alkali as shown above, the 169 grains per gallon contains but 33 grains of carbonate.

The new sump was dug near a very strong black alkali bed just outside of the adjoining fence on the outside of the tract. No water from this alkali drains into the sump except on the immediate border; the drainage is chiefly from the irrigation of the plats that have been reclaimed by gypsum. But the high proportion of carbonate of soda shows that some of the black alkali of the outside does reach the sump and is dissolved. This sump and the ditch in which it is located were dug to prevent the percolation of the alkali across into the substation tract and interfere with its reclamation, and have proved very effective.

Alkali Soils from near Traver, Tulare County; sent by J. P. McCarthy, San Francisco. The samples were taken from different alkali spots of the field, to a foot in depth. Alfalfa will not grow upon this land, because of the alkali. Examination of the samples gave the following results:

	Soil No. 1.		Soil No. 2.		Soil No. 3.	
	Per Cent.	Pounds Per Acre.	Per Cent.	Pounds Per Acre.	Per Cent.	Pounds Per Acre.
Sulfate of Soda	.054	2,160	.140	5,600	.082	3,280
Carbonate of Soda	.050	2,000	.153	6,120	.009	360
Chlorid of Sodium	.046	1,840	.386	15,440	.515	20,600
Totals	.150	6,000	.679	27,160	.606	24,240

In these soils the sulfate (glauber salt) is within the limit of tolerance and not injurious to culture plants. But the other two salts are excessive in soil No. 1, and enormously so in No. 2. In No. 3 the carbonate of soda is very low in amount, but the chlorid (common salt) reaches one half of one per cent, or at the rate of 20,600 pounds per acre in the upper foot. The remedy indicated by these results is a dose of gypsum for soils Nos. 1 and 2, in order to change the carbonates (black alkali) into the sulfates, and removal of the alkali from each of the three soils by leaching and drainage; or by driving the alkali downward by thorough soaking of the soils with water and taking proper means to keep it from rising again to the surface.

Alkali Soils from Clearwater, Los Angeles County; sent by C. P. Eldridge. Four samples were sent and their examination showed the presence of the following amounts of the alkali salts:

	Soil No. 1.		Soil No. 2.		Soil No. 3.		Soil No. 4.	
	Per Cent.	Pounds Per Acre.	Per Cent.	Pounds Per Acre.	Per Cent.	Pounds Per Acre.	Per Cent.	Pounds Per Acre.
Sulfate of Soda	.154	6,160	.158	6,320	1.027	41,080	.530	21,200
Carbonate of Soda	.086	3,440	.034	1,360	.560	22,400	.330	13,240
Chlorid of Sodium	.054	2,160	------	--------	--------	--------	------	--------
Total	.294	11,760	.192	7,680	1.587	63,480	.861	34,440

With the exception of sample No. 2, these soils are by far too heavily charged with the alkali salts, and especially with the carbonate of soda, to permit the successful growth of culture plants. The sulfate of soda itself is far too large in all but the first two, and even in them it is near the danger limit.

Alkali Crust, from near Kings City, Monterey County; sent by William Winterhalter. Its composition was: Sand, 65.0 per cent; Sulfate of Soda, 23.27; Carbonate of Soda, a trace; Chlorid of Sodium, 4.25; other substances, 7.48 per cent.

The alkali in this sample was of the "white" kind, because of the absence of carbonate of soda; and while a little more than one fourth of the crust was composed of this, there is not sufficient to produce any serious injury to crops.

Alkali Soils from Mendota, Fresno County; sent by W. S. Palmer, engineer of the Southern Pacific Railroad Company. The first sample was taken to the depth of a foot early in December, while the samples to the depth of four feet were taken later. The results of the examination were as follows:

	Percentage in Soil.				Pounds Per Acre.			
	Alkali Sulfates	Carbonate of Soda	Chlorid of Sodium	Total.	Alkali Sulfates	Carbonate of Soda	Chlorid of Sodium	Total.
Sample No. 1	.746	.034	1.129	1.909	29,840	1,360	45,160	76,360
Sample No. 2—								
First foot	.103	.025	.004	.132	4,120	1,000	160	5,280
Second foot	.109	.034	.031	.174	4,360	1,360	1,240	6,960
Third foot	.763	.009	.157	.929	30,520	360	6,280	37,160
Fourth foot	1.080	.009	.291	1.380	43,200	360	11,640	55,200
Total in four feet	.514	.019	.121	.654	82,200	3,080	19,320	104,600

The above soils are very severely charged with alkali salts; in fact more so than any yet examined in the State. There is, however, comparatively little carbonate of soda, thus placing the soil in the "white alkali" class. The low amount of carbonate of soda is doubtless due to the fact that these lands contain more or less gypsum. The common salt in the four feet is enormous in amount, and when added to the high content of sulfate is enough to account for the barren land when the alkali is allowed to rise to the surface.

The alkali in the upper foot of the four feet series can be tolerated by plants, but excessive irrigation will bring up the heavy reinforcement from below.

Alkali Soil from the old bed of Tulare Lake, taken one foot in depth; sent by W. E. Dennison, San Francisco.

	Per Cent.	Pounds Per Acre.
Sulfate of Soda	.570	22,800
Carbonate of Soda	.051	2,040
Chlorid of Sodium	.323	12,920
Total	.944	37,760

The presence of so much total alkali salts makes this soil entirely unfit for the culture of any plant unless it be the Australian saltbush, and even that would have to struggle for an existence until it became well rooted.

Alkali Soil from San Jacinto, Riverside County; sent by J. A. Cook. Its composition was as follows:

	Per Cent.	Pounds Per Acre.
Sulfate of Soda	.165	6,600
Carbonate of Soda	.017	680
Chlorid of Sodium	.204	8,160
Total	.386	15,440

This soil is unsuited for the growth of orchard trees or other ordinary cultures, for the very large amount of common salt would produce serious injury.

Alkali Soil from near Kings River, two miles north of Traver, Tulare County; sent by Mrs. Dora Brown. The sample represents a foot in depth, and was found to contain the following:

	Per Cent.	Pounds Per Acre.
Sulfate of Soda	.293	11,720
Carbonate of Soda	.560	22,400
Chlorid of Sodium	.187	7,480
Total	1.040	41,600

This soil contains black alkali in the extreme, the amount of the carbonate alone being twelve times that tolerated by culture plants; in fact, the amount of each of the ingredients taken separately is more than most culture plants can endure.

Alkali Soil from Escondido. Taken from a spot where alfalfa died; sent by H. W. Coute.

	Per Cent.	Pounds Per Acre.
Sulfate of Soda	.487	19,480
Carbonate	.034	1,360
Chlorid	.636	25,440
Nitrate	.002	80
Total	1.159	46,360

There is not enough carbonate of soda to very seriously affect the growth of alfalfa, but the amount of chlorid of sodium (common salt) is enormous, in fact sufficient to kill almost any culture plant except, perhaps, the Australian saltbush.

Alkali Soil from fifteen miles south of Bakersfield, Kern County; sent by D. E. Josephi. Sample was taken only two inches deep.

	Per Cent.	Pounds Per Acre.
Sulfate of Soda	4.33	28,870
Carbonate	.30	2,000
Chlorid	.21	1,400
Total	4.84	32,270

It will be seen that for the two inches alone in this soil there is almost enough alkali to reach the limit of tolerance in most culture plants, and it is more than probable that the amount would be very largely increased had the sample been taken to represent a foot in depth instead of the upper surface.

3. WATERS.

The chemical examination of waters of the State, sent in by private individuals, still occupies a large part of the time of the Station chemists, very much to the detriment of other lines of investigation. The larger part is, however, of utmost importance to the farming communities where used for irrigation purposes, for in many instances we have found the water so highly charged with alkali as to make its use on the land dangerous to vegetation. The number of waters reported in this volume is about eighty-five, and the analyses have been made by the various Station chemists as their work would permit. Three fourths of these were made by F. J. Snow and Leroy Bishop, students in the Agricultural Laboratory; the others were made by Messrs. Jaffa, Colby, and Loughridge, chemists of the Station.

A. STREAM AND LAKE WATERS.

But one of the samples of water of streams that have been examined is suitable for general use, viz: that of the mountain creek near Hollister, as shown in the accompanying table. It is a "hard" water, and would doubtless form a crust in boilers, but the trouble could easily be remedied by the usual methods.

Composition of Stream and Lake Waters.

Locality.	County.	Sender.	Grains per Gallon.					
			Total Salts...	Glauber Salt ...	Common Salt ...	Sal Soda..	Lime Carbonate, etc......	Silica......
Mountain Creek, Hollister......	San Benito..	C. N. Hawkins...	14.42	3.07	.68	.62	10.05	....
Plato Creek	Kern	Kern Co. Land Co.	127.57	88.51	5.45	1.23	27.35	5.03
Creek near Los Angeles.......	Los Angeles	Gus Kleman	171.14	100.91	10.91	.62	57.54	1.16
Pecos River, N. Mexico........	....	J. T. Taylor.....	185.60	37.50	37.50	....	110.50	- --

Water from Lake Elsinore, Riverside County. The samples were taken at different times and places, as follows: In 1890 a sample was sent by Peter Wall, of Elsinore. (See Station Report of 1890, p. 52.) In 1891 another was sent by N. Messer, of Wildomar, San Diego County. In 1897, George Van Kirk, of Corona, sent a sample taken from the intake at the lake; while F. H. Sears forwarded one from the hydrant in Corona. In 1898, during an examination of the orchards of Corona, a

sample was taken by R. H. Loughridge from the flume, about one half mile from where the water enters the orchards of Corona.

The following are the results obtained by analysis made soon after each sample was received by the Station:

WATER OF LAKE ELSINORE.

	Grains per Gallon.				
	1890.	1891.	1897.		1898.
			Lake.	Hydrant.	
Total residue by evaporation	103.21	84.34	88.80	98.42	116.18
Sodium and Potassium Sulfates (glauber salt, etc.)	76.00	14.85	------	20.11	22.03
Sodium Chlorid (common salt)		43.37	------	47.05	53.62
Sodium Carbonate (sal soda)	19.22	13.62	13.30	21.04	22.89
Calcium and Magnesium Carbonates, and Gypsum	2.75	5.49	------	4.96	7.01
Silica	Trace	.47	------	.88	2.45
Organic Matter and Combined Water	5.25	6.54	------	4.38	8.18

The strong alkaline character of the water is at once recognized in the high amounts of carbonate and chlorid of sodium. It is also at once apparent that irrigation with this water will place in the soil dangerous quantities of both of these salts, which, with the light annual rainfall of the region, will rapidly accumulate. The change in the strength of the water from year to year, as shown above, is due to dilution by precipitations of rainfall on the hillsides, or to evaporation and concentration in the absence of such rainfall.

B. SPRING WATERS.

Sixteen spring waters were examined during the year, and of these but six were found to be suitable for domestic or irrigation uses, though two were extremely "hard" from the presence of large amounts of lime carbonate. This could be remedied for cooking or for boilers by proper treatment with sal soda and allowing the lime precipitate to settle.

Of the group of waters considered unsuitable for use, there is one that for certain purposes might form an exception. It is the Hollister water, in which there is 27 grains of sal soda per gallon. This water is not laxative and most persons may drink it without harm, if in moderation. But its application to land in irrigation would quickly produce a bad case of "black alkali." The other waters are too heavily charged with glauber salt and common salt for any other than medicinal use, and several of them contain far too much of these and of sal soda for irrigation.

COMPOSITION OF SPRING WATERS.

Locality.	County.	Sender.	Grains per Gallon.					
			Total Salts.	Glauber Salt.	Common Salt.	Sal Soda.	Lime Carbonate, etc.	Silica.
Suitable for Use.								
1. Near Willows, No. 1	Glenn	Thos. L. Knock	8.77	.24	.68	.25	7.60	----------
2. Near Willows, No. 2	Glenn	Thos. L. Knock	9.34	.36	.68	.12	8.18	----------
3. Laurel Glen Farm	Napa	A. V. Stubenrauch	13.43	2.12	1.02	1.23	25.43	.11
4. Monte Vista, San José	Santa Clara	M. D. Phelps	6.84	.66	----------	.62	5.56	----------
5. Mineral King—"Iron"	Tulare	W. H. Hammond	11.97	1.73	----------	2.48	7.18	.59
6. Mineral King—"Soda"	Tulare	W. H. Hammond	37.50	1.65	1.36	2.48	29.96	2.05
7. Mineral King—"Arsenic"	Tulare	W. H. Hammond	110.10	3.58	----------	3.72	100.76	.11
Not Suited for Domestic Use or Irrigation.								
8. Clark's Valley	Glenn	Thos. L. Knock	68.46	37.60	4.09	1.23	25.43	.11
9. Near Hollister	San Benito	R. W. O. Brannon	39.71	3.55	2.52	27.50	4.09	2.04
10. Livermore	Alameda	Theo. Gier	119.74	32.99	51.83	18.57	10.62	5.73
11. Mountains near Saticoy	Ventura	A. W. Fulton	65.13	30.32	19.78	2.48	8.76	3.79
12. Near Ventura	Ventura	J. T. Stockton	237.61	50.70	44.33	115.13	21.61	5.84
13. Santa Paula	Ventura	H. Anlauf	286.10	26.25	129.58	62.51	66.30	1.46
14. San José	Santa Clara	Paul Marson	296.73	42.28	136.40	6.19	108.36	3.50
15. Parkfield	Monterey	John A. Greenlaw	1882.34	1648.26	208.40	24.76	2.34	.59
16. Santa Clara	Santa Clara	F. G. Sanborn	674.00	----------	----------	----------	----------	----------

C. COMMON WELL WATERS.

During the past season thirty-eight samples of water from ordinary wells have been examined for individuals. For convenience and economy in space the results are placed in general tables arranged in two groups, comprising those suitable for general use, and those which are too highly charged with mineral salts to make them suitable for either domestic or irrigation use.

Suitable for Use.—In this group there are several that should be perhaps placed in the doubtful list, because of their large content of permanently soluble salts. One is from a well on Taylor Island, in Sacramento County; it contains much common salt, and its glauber salt might disturb sensitive stomachs in course of time. The others are from Los Angeles and Riverside, and their rather high content of glauber salt would act as a laxative with many persons.

The majority of the waters are "hard" from the presence of more than six grains of lime salts per gallon; but either boiling or treatment with lime water, or the addition of a little sal soda or borax so as to make the water take soap readily, will remedy the evil. In steam boilers a hard crust is apt to form in the use of these hard waters, unless preventives are used. These might be either the application of eucalyptus extract to the boiler, or the precipitation of the lime and magnesia with sal soda in a service tank previous to the use of the water, which should be allowed to settle at least over night.

Unfit for Domestic Use or Irrigation.—All of the waters in this group have too high a content of mineral salts, either of glauber or common salt, to make them suitable for either use. Many of them are medicinal in character, and the majority are very "hard" from the presence of lime salts. Those from Los Gatos, Hollister, and King City could not be safely used permanently for irrigation, for unless the soils were very deep and sandy, and systematic washing-out was practiced, there would in the course of a few years be an accumulation of "white alkali" (glauber and common salt) which would injure crop production.

Composition of Common Well Waters.

Locality.	County.	Sender.	Grains per Gallon.						
			Total Residue.	Glauber Salt.	Common Salt.	Sal Soda.	Lime Carbonate, etc.	Silica.	Organic Matter and Combined Water.
Suitable for Use.									
1. Near Diamond Springs	El Dorado	A. L. Kramp	9.81	.65	.68	1.23	3.39	3.10	.76
2. Gridley	Butte	H. Cook	19.27	.36	1.36	.62	8.18	3.50	5.25
3. Taylor Island	Sacramento	H. Voorman	35.05	7.12	15.00	1.24	7.89	2.34	1.46
4. Napa	Napa	A. F. Allen	6.42	1.19	1.36	1.24	.88	.58	1.17
5. Santa Rosa (De Turk Vineyard)	Sonoma	W. H. Lumsden	21.33	2.34	----	----	11.97	.59	6.43
6. Cloverdale	Sonoma	J. C. Robertson	32.41	2.44	2.72	2.47	14.90	5.55	4.33
7. Fruitvale	Alameda	Mrs. Mauerham	42.34	8.63	12.61	1.24	12.09	1.05	6.72
8. Berkeley	Alameda	J. B. Davy	30.37	6.19	2.86	----	14.60	1.17	5.55
9. Berkeley	Alameda	R. Flint	45.26	7.85	6.13	2.47	11.86	2.33	14.62
10. Berryessa	Santa Clara	W. S. H. Shelley	26.87	.30	4.09	4.96	11.39	.29	5.84
11. Los Gatos	Santa Clara	R. P. Gober	21.26	1.54	3.06	1.24	6.72	.59	8.11
12. Fresno	Fresno	W. J. McNulty	19.45	3.07	.68	.62	4.20	8.55	2.33
13. Fresno	Fresno	W. H. Hodgkins	15.18	1.62	.68	.61	7.31	2.33	2.62
14. Tulare	Tulare	S. F. Hoover	9.06	1.34	1.36	3.71	.60	.59	1.45
15. Bakersfield	Kern	D. E. Josephi	16.91	4.77	1.36	----	7.30	1.17	2.33
16. Paso Robles	San Luis Obispo	D. Kochler	35.92	5.39	4.77	1.23	17.52	.88	6.13
17. Long Beach	Los Angeles	J. D. Moody	16.06	9.54	1.36	2.48	.60	1.16	.93
18. Long Beach	Los Angeles	Orlinda Feathers	23.95	7.59	4.09	----	7.24	.94	4.09
19. Corona	Riverside	Pacific Mf'g Co.	29.38	9.95	5.45	1.23	8.77	1.93	2.05
20. Alametos	Orange	T. G. Van der Bosch	18.40	4.54	.68	.62	7.30	2.34	2.92
21. Orange	Orange	A. D. Bishop	23.01	6.51	1.36	1.24	11.45	.47	1.98

Composition of Common Well Waters—*Continued.*

Locality.	County.	Sender.	Grains per Gallon.					
			Total Salts.	Glauber Salt.	Common Salt.	Sal Soda.	Lime Carbonate, etc.	Silica.
Not Suitable for Use.								
1. Los Gatos	Santa Clara	J. C. Strong	38.54	17.36	.68	1.23	18.39	.88
2. Near Hollister	San Benito	R. C. Gury	41.18	24.22	1.09	1.85	12.56	1.46
3. Purissima	San Mateo	Joe Taylor	75.35	37.55	5.45	3.71	23.15	5.49
4. Alameda	Alameda	Geo. C. Ecker	56.39	9.24	17.73	1.23	25.82	3.27
5. Pajaro	Santa Cruz	C. K. Ercanbrack	54.79	11.56	2.72	5.57	32.02	2.92
6. King City	Monterey	Wm. Winterhalter	109.64	71.15	17.05	----	19.86	1.58
7. King City	Monterey	Wm. Winterhalter	31.60	13.24	5.45	----	11.98	.93
8. Madera	Madera	A. I. Sayre	128.03	.60	98.00	1.85	22.50	5.08
9. New Idria	Fresno	G. S. Nash	159.45	114.24	9.55	.62	33.58	1.46
10. Bakersfield	Kern	S. Dickenson	87.33	52.38	23.19	1.24	9.35	1.17
11. Goodwin	San Luis Obispo	Peter McCart	575.93	351.81	129.58	1.95	87.04	5.55
12. Santa Barbara	Santa Barbara	Mrs. A. P. Redington	1482.11	1223.42	236.79	1.24	19.85	.81
13. Ventura	Ventura	J. W. Sweat	329.27	48.61	238.70	1.24	39.13	.59
14. Long Beach	Los Angeles	R. E. Peck	220.78	86.77	99.57	3.72	30.72	----
15. Otay	San Diego	F. H. Downs	40.81	5.90	23.56	1.23	8.77	1.35
16. Sunny Side	San Diego	S. W. Gleghorn	230.72	20.75	180.04	2.48	26.87	.58
17. Los Angeles	Los Angeles	E. P. Sawyer	49.99	14.44	19.77	1.24	11.80	2.74

D. WATERS OF ARTESIAN WELLS, RESERVOIRS, AND IRRIGATION DITCHES.

Among the artesian waters examined, that from Hollister contains so much mineral salts, and especially glauber salt, as to make it unfit for domestic use; it would exert a laxative effect upon most persons. The waters from Colton and Riverside might also prove rather laxative upon delicate constitutions.

For irrigation purposes the Hollister water is so strongly charged with salts that upon heavy soils there would soon be an accumulation of black alkali; it might be used upon light, pervious soils if applied abundantly. Water No. 3 also contains so much common salt that it should only be used upon pervious soils in abundance to avoid accumulation of the salt in the region of the feeding roots of trees.

For domestic uses the Jamacha reservoir contains more of mineral salts than is regarded as the limit, while its glauber salt and gypsum would give a certain degree of purgative quality. The ditch water from Caruthers has quite a large amount of glauber and common salt, which might be too laxative upon persons with weak constitutions.

For irrigation purposes the Jamacha and Caruthers waters should not be used except upon very pervious soils, and then only in large amounts sufficient to soak beyond the feeding roots. On heavy soils there would in a few years be an accumulation of common salt sufficient to produce serious injury to trees or plant growth.

COMPOSITION OF ARTESIAN WELL WATERS.

Locality.	County.	Sender.	Depth of Well—Feet.	Grains per Gallon.					
				Total Salts.	Glauber Salt.	Common Salt.	Sal Soda.	Lime Carbonate, etc.	Silica.
1. Hollister	San Benito	M. Luther	225	66.94	19.40	19.09	6.19	10.51	1.75
2. Colton	San Bernardino	F. B. Hathaway	-------	19.57	11.74	2.04	4.33	.88	.58
3. San Bernardino	San Bernardino	Geo. B. Rowell	500	21.32	2.68	10.91	4.33	2.52	.88
4. North of Riverside	Riverside	Wm. Elliott	110	19.43	10.32	4.09	1.23	.87	2.92
5. Westminster	Orange	A. D. Bishop	118	18.40	6.93	.68	1.84	8.36	.59

WATERS OF RESERVOIRS AND IRRIGATION DITCHES.

Locality.	County.	Sender.		Total Salts.	Glauber Salt.	Common Salt.	Sal Soda.	Lime Carbonate, etc.	Silica.
1. Palo Alto	Santa Clara	Wm. Snow	Hydrant	18.40	5.06	1.37	4.96	5.84	1.17
2. Caruthers	Fresno	Geo. Dodd	Ditch	39.43	10.50	20.46	4.09	3.80	.58
3. Cucamonga	San Bernardino	E. Firth	Ditch	18.04	6.25	.14	.62	9.57	1.46
4. Near Westminster	Orange	A. D. Bishop	Drain	17.99	5.01	1.36	1.85	9.53	.23
5. Near Westminster	Orange	A. D. Bishop	Ditch *	19.63	7.35	.95	1.85	7.89	1.58
6. Riverside	Riverside	Land & Irr. Co.	----------	17.56	7.92	1.36	6.19	.71	3.38
7. Jamacha	San Diego	H. E. Nelles	Reservoir	52.14	6.56	23.87	2.85	16.06	2.80
8. Etiwanda	San Diego	C. A. Scanland	Ditch	15.35	7.08	2.04	.61	5.15	.47

* From Santa Ana River, 12 miles distant.

SANITARY EXAMINATIONS.

In a number of instances examinations were made of waters suspected of sewage or other contaminations. The results were as follows:

Locality.	County.	Sender.	Grains per Gal.		Parts per Million.		
			Total Residue	Chlorine	Ammonia. Free	Ammonia. Albuminoid	Oxygen Consumed in Moist Combustion
Spring Waters.							
Mt. Hamilton—							
Spring	Santa Clara	Prof. Schaeberle	6.59	.41	.024	.060	2.20
Spring reservoir	Santa Clara	Prof. Schaeberle	9.34	.42	.015	.397	4.24
Old Kepler resv'r	Santa Clara	Prof. Schaeberle	9.93	.60	.030	.364	3.24
New Kepler resv'r	Santa Clara	Prof. Schaeberle	12.55	.42	.025	.304	7.60
Palo Alto hydrant	Santa Clara	Wm. Snow	22.48	1.37	.010	.015	1.00
Livermore spring	Alameda	Theo. Gier	126.75	1.14	.718	.354	9.00
Laurel Glen Spring	Napa	A.V. Stubenrauch	14.77	.62	.053	.050	1.40
Common Wells.							
Berkeley	Alameda	R. Flint	45.26	3.74	.024	.037	6.00
Berkeley	Alameda	J. B. Davy	30.37	1.74	.060	.060	1.00
Fruitvale	Alameda	Mrs. Mauerham	42.34	7.69	.054	.050	3.77
Alameda	Alameda	G. E. Ecker	83.41	10.81	.040	.170	4.20
Los Gatos	Santa Clara	R. P. Gober	21.26	3.06	.026	.028	1.40

The results show that the Mount Hamilton reservoir waters were beyond the limit of tolerance in albuminoid ammonia contamination; that from the Alameda well contained a notable quantity, while the Livermore spring water was heavily charged with free ammonia in addition. The other waters are comparatively free from contamination.

THE USE OF SALINE AND ALKALI WATERS IN IRRIGATION.*

By E. W. Hilgard.

The vital importance of irrigation in the arid region, and the consequent high value of irrigation water, offer a great temptation toward the use of waters containing relatively large amounts of saline ingredients, which, from the very nature of the case, are of very frequent occurrence. The origin of these saline contaminations is of course the same as that of the alkali lands themselves; such waters may, in the majority of cases, be considered as the leachings of alkali lands. That the occurrence of the latter is essentially the result of a deficient rainfall, insufficient in amount to carry the salts naturally formed in the

* Read at the Irrigation Congress at Lincoln, September 28-30, 1897, and the Horticultural Convention, Sacramento, November 17, 1897.

weathering of all soils, into the country drainage, as currently happens in the regions of summer rains, has been sufficiently explained in former publications of this Station, which have also set forth the means that may be used toward the reclamation of alkali lands for profitable culture.

It is evident that if alkaline waters are used for irrigating lands already more or less charged with alkali, the amount of the latter may be readily increased to an extent that may render the continuance of profitable culture impossible. As stated elsewhere, and is but too well known to many irrigators, this not uncommonly happens, even when the purest water is used for irrigation; a very troublesome phenomenon, which is popularly known as "the rise of the alkali." The causes which lie at the bottom of this process have been fully shown by investigations made at this Station; it results from the accumulation near the surface, and therefore within easy reach of the roots and root-crowns of culture plants, of the alkali salts which for long periods have been accumulating in the depths of the subsoil, near the level to which the annual rainfall reaches. The amount of irrigation water used being usually no more than is necessary to wet the land to the depth absolutely required for the welfare of the crops, but not sufficient to carry the alkali salts into the country drainage, the accumulated salts are dissolved, and subsequently by surface evaporation of the water, are themselves carried near or to the surface, until the entire mass formerly distributed through three or four feet of soil and subsoil is accumulated within a few inches of the surface, where they will do the most harm to vegetation; the injury to the latter being in the majority of cases due to a corrosion of the root-crown by the strong saline solution.

If, as is well known, this happens even when the purest water is used for irrigation, the evil must be aggravated in proportion to the additional amounts of salts carried into the land by saline irrigation waters. In the case of some waters used for irrigation within the last few years, the alkali content has been so great that soils heretofore wholly free from alkali contamination have been converted into genuine alkali lands; incapable of being used for ordinary cultures, but only for such as are tolerant of such salts. In several instances this has been done despite the warning given by this Station as to the inevitable results of the use of such waters under any ordinary conditions or modes of operating; and among the reasons assigned for so doing has sometimes been the unquestioned fact, that luxuriant vegetation is found growing along the shores or margins of lakes and streams to which the warning applied. It therefore seems necessary to explain why this is so, and that it is perfectly consistent with the correctness of the objections made to the use of the water.

As a matter of fact, but few waters naturally occurring, such as those of the ocean, Great Salt Lake, Mono Lake, and others, are sufficiently strong to prevent or destroy vegetation of which they bathe the roots, *so long as their saline strength is not increased and concentrated by evaporation.* According to investigations made in Europe early in this century, it takes over a thousand grains of common salt per gallon to prevent the growing of most culture plants *in* water; a few will tolerate as much as fifteen hundred. According to our own experiments, plants will tolerate more than twice as much of glauber salt (sulfate of soda) as they will of common salt; but carbonate of soda is nearly three times

more injurious than common salt to the growth of many plants. As these three salts—the sulfate, carbonate, and chlorid of sodium—constitute in varying proportions the bulk of what is known as white and black alkali, it will be readily understood that according to the nature of these salts, and of others occasionally accompanying them, the tolerance of plants for them may vary greatly for the same total amount of soluble salts contained in the water. For this reason alone, then, it is not easy to give figures or percentages stating exactly how much "alkali" in soil or water a plant will tolerate.

A series of elaborate culture tests on alkali lands that have been made by this Station during the last five or six years have shown approximately the tolerance of some of the more important culture plants for alkali salts. Some of these figures have been given in former reports, while others are given for the first time in the present one; and these experiments and investigations are being continued under the numerous varying conditions that may determine tolerance or non-tolerance.

Among these varying conditions, apart from the composition of the alkali salts, above referred to, the most important appears to be the nature of the soil in regard to "perviousness" and "lightness" on the one hand, and "closeness" and "heaviness" on the other. For, light soils hold a smaller amount of water in their pores than heavy ones, and permit more readily of "leaching through," by which the soil may be freed of its alkali salts. Clay soils, on the contrary, hold a large amount of water much more tenaciously, and it is difficult, sometimes impossible, to effect any leaching-out of alkali salts, unless by the aid of tile underdrains.

These preliminaries being understood, it is not difficult to see why and how alkaline irrigation water may be used with impunity on some lands, while promptly fatal to the producing power of others. One and the same amount of irrigation water may, in sandy land, readily penetrate to the natural subdrainage, thus preventing the accumulation of alkali in the soil by surface evaporation; while used on "adobe," it will not only not penetrate to the subdrainage, but, remaining within a few feet of the surface, will in a short time evaporate there, carrying upward with it the entire mass of alkali salts in the soil, undiminished. In such lands it is only by long soakage that the alkali salts can be sensibly diminished; it is utterly idle to attempt to wash them off the surface by a rush of water, for at the very first touch the strong solution first formed is absorbed into the dry soil and thereafter penetrates downward instead of upward.

It is thus obvious that when we can apply to a fairly pervious soil an amount of saline irrigation water large enough to wash out into the subdrainage any former accumulations, and when this operation is repeated at intervals not too long, nor surface evaporation allowed to progress to too great an extent, relatively strong saline waters may be used for ordinary culture plants with impunity; they being then substantially under the same conditions as the luxuriant vegetation so commonly found on the margins of alkali lakes.

But it is quite otherwise when the same water is used according to the ordinary practice of irrigators, viz: only to the extent required to wet the root-system, repeating this wetting at such intervals as may be required for the welfare of the crop, but never to such an extent as to

wash the accumulated salts out of the land. The total amount of salts contained in the successive masses of irrigation water are then accumulated and retained in the soil; and this accumulation soon becomes formidable if the water is at all strongly charged, or if the soil should already contain an amount of alkali closely approaching the limits of tolerance. When the amount and kind of salts in the water have been determined by a chemist, it is a simple question of arithmetic to estimate how much alkali is added to the soil each year, and accordingly to calculate the number of years within which the soil will become incapable of bearing ordinary crops. To illustrate this by an example: Suppose a water used for irrigation to contain 100 grains of alkali salts per gallon, as in the case of Lake Elsinore and Tulare, in California, and that irrigation is used to the extent of supplying an annual deficiency of 15 inches of rainfall (or 15 acre-inches), to wit, 408,375 gallons. This amount of water would contain something over 5,300 pounds of salts; and were these fully retained in the land, this addition would be made annually.*

Comparing this with some of the actual amounts found in land approaching the limits of toleration, we find that in the experimental plot at the Southern California substation, which contains within the first three feet from 7,000 to 12,000 pounds of comparatively mild alkali (chiefly glauber salt), most of the commonly cultivated grasses, clovers, and vegetables refuse to grow or fail to produce satisfactory crops; while nevertheless excellent high-grade sugar beets are grown on the same ground. At the Tulare substation it was found that sugar beets failed to produce satisfactorily when 18,000 to 20,000 pounds were contained in the land. Nearly the same limit of toleration applies there to wheat; while barley will under favorable conditions resist as much as 32,000 pounds per acre in three feet depth, which may be considered as its extreme limit of toleration. But on the same land ordinary fruit trees already planted either die or maintain but a feeble existence. Citrus trees of considerable age have died out under these conditions so soon as the soil in which they grew was by irrigation raised to 15,000 pounds per acre (or even less) of saline contents.

While the above figures are mere approximations obtained under special conditions, and varying for different soils to a greater or less extent, they are quite sufficient to show that the annual addition of, say, 5,000 pounds of alkali salts to any soil cannot be long continued with impunity; always supposing that the whole of the alkali contained in the irrigation water remains in the land. In many cases, especially where water is scarce, this is strictly true; and three years' irrigation has sufficed to render land formerly capable of producing all kinds of crops, unfit for any save those which, like the beet, the sunflower, and others, are specially tolerant of alkali salts. It would take but a few years of such régime to kill out any citrus orchard; and deciduous orchards would follow in short order.

The subject is really simple enough to be understood by any one capable of doing a sum in arithmetic, and of judging to what extent, if any, his customary method of irrigation relieves the land of alkali salts that may have been introduced by irrigation water. The principle of

*In the semiarid region (e. g. in South Dakota) waters of the above strength have been used with impunity for several years past; but only to supplement the annual rainfall for a short time, to the extent of 2 to 3 acre-inches.

the whole matter may be summed up as follows: When water containing any considerable amount of alkali salts is used for irrigation, it should be used very abundantly at least once a year, so as to wash the alkali through into the subdrainage if possible. On light soils this can be readily done; on heavy soils it is extremely difficult to do it effectually without the aid of underdrains. And such lands in their natural condition are therefore most readily injured by the use of alkaline irrigation water.

The question is frequently asked, how much alkali in a water will render it objectionable for irrigation use? From what has been already said, it will be easily understood that this question does not admit of a definite answer; since both the quality of the saline contents, and the nature of the soil, together with possibility of liberal and judicious use of the water, require to be considered.

Broadly speaking, *any water unfit for domestic use on account of its saline contents should be used for irrigation only after an examination of the nature and amount of the latter.* The limit usually given for drinking waters is 40 grains per gallon.

Suppose that all or nearly all of such matter were gypsum, however, the water would still be good for irrigation, and in fact preferable to purer water in most cases. In some good irrigation waters of Texas and New Mexico, flowing from the gypsum beds, as much as 160 grains is found. But these waters are wholly unfit for drinking.

On the other hand, were a water proposed to be used for irrigation found to contain that amount of common or glauber salt, it would be difficult to use it without injury save on the very lightest lands, and for very tolerant crops. But even 40 grains per gallon of *carbonate of soda* would be at least equally dangerous, unless used in conjunction with gypsum to transform the "black" into "white" alkali. Even water containing 20 grains of the former has in some instances caused serious trouble in three or four years. Each case must therefore be considered on its own merits, and with due regard to all the surrounding conditions.

4. CATTLE FOODS, SUGAR BEETS, ETC.

INVESTIGATION OF CALIFORNIA CATTLE FOODS.

By M. E. Jaffa.

The following table summarizes the chemical work along this line of investigation since our last report was issued. The analyses were, with two or three exceptions, made by Mr. F. J. Snow.

Sugar-Beet Tops.—One of the problems now confronting the dairyman is to economically make for export a hard butter, one with a high melting point that will be in a salable condition after reaching its destination. In addition to the desirability of producing for the foreign market a firm butter, the dairyman should also strive to make for home consumption an article which will not be too soft or oily, nor so hard that it is spread with difficulty, if at all, on the bread.

The attainment of these ends can only be had by a proper blending of the foods. If the materials fed were corn meal and cottonseed meal for a grain ration, combined with barley stubble as pasture, the resulting butter would in all probability be too hard for home use. An extremely soft butter, on the other hand, would be produced by a ration consisting of grass, linseed meal, and bran.

Some feeders state that sugar-beet tops is one of the best feeds available for the production of a firm butter. The Station expects in the near future to make some elaborate chemical tests on such butters.

The sugar-beet tops consist of leaves and crowns of the root (all that part which has a greenish tinge), in the proportion of 76 per cent of leaves and 24 per cent of crown.

The analyses of leaves (No. 76), crown (No. 77), and tops (No. 78) are given in Table I.

An inspection of the figures showing the composition and nutritive value of the sugar-beet tops proves that water constitutes about seven-eighths of this material. 100 pounds of the fresh substance is found to contain 8.25 pounds of digestible nutrients, proportioned as follows: protein, 1.71 pounds; carbohydrates, 6.49 pounds; and fat, .05 of a pound, with a valuation of $1.58. The analysis and valuation previously published were obtained from an Eastern source; our late work proves the tops to rate the same for protein, but to be slightly richer in carbohydrates, thus increasing the value from $1.40 to $1.58. The fertilizing value is about $1.65.

From these figures we see that the material as such is worth more as a fertilizer than as a cattle food. The above estimate of the tops as a fertilizer does not include the vegetable matter, which as a green-manure has considerable value. But it is said that if the tops are used as a food

TABLE I. COMPOSITION OF SOME CALIFORNIA CATTLE FOODS.

Serial Number	Food Material.	Original Substance.											
		Percentage Composition.						Amount Digestible in 100 Pounds.				Potential Energy in One Pound Calories.	Nutritive Ratio
		Moisture.	Ash.	Crude Protein.	Crude Fiber.	Nitrogen-Free Extract.	Crude Fat.	Protein.	Fiber.	Nitrogen-Free Extract.	Fat.		
76	Sugar-beet Leaves	88.75	.67	1.91	1.42	7.22	.03	1.72	.47	4.13	.03	119	1:2.7
77	Sugar-beet "Crowns"	81.92	.81	1.91	1.91	13.38	.07	1.72	.64	12.05	.07	271	7.5
78	Sugar-beet Tops	87.14	.70	1.91	1.53	8.68	.04	1.72	.50	5.99	.05	155	3.8
79	Foxtail Hay	12.00	5.39	7.45	33.53	39.79	1.84	4.25	16.76	24.66	.92	888	10.2
80	Eriogonum Parvifolium	10.40	7.18	9.85	34.54	34.50	3.92	5.61	17.27	21.39	1.96	906	7.7
81	Corn Meal	12.05	1.54	9.40	2.00	71.34	3.67	6.38	.66	65.63	3.37	1,506	11.5
82	Wheat Bran	11.84	6.52	12.60	8.52	56.85	3.67	9.45	2.84	39.79	2.57	1,087	5.1
83	Wheat Bran	11.12	6.64	15.10	9.85	52.79	4.50	11.33	3.28	36.95	3.15	1,091	4.1
84	Wheat Middlings	11.61	2.40	12.50	4.86	63.88	4.75	10.00	1.21	49.18	3.33	1,264	5.8
85	Shorts	11.45	4.90	15.60	5.05	58.28	4.72	12.48	1.26	44.88	3.30	1,229	4.3
86	Mixed Feed	10.29	5.10	14.04	8.22	55.75	6.60	10.53	2.46	41.81	4.95	1,228	5.3
87	Rolled Barley	10.05	2.90	12.00	2.30	69.63	3.12	9.60	.79	62.66	2.08	1,446	7.1
88	Rice Hulls	11.02	16.04	5.36	37.12	29.54	.92	2.68	10.14	20.67	.78	744	12.1
89	Rice	....	....	6.60	....	....	....	4.32	....	....	....	....	....

and the manure saved, about three fourths of the fertilizing value of the original substance is still retained. While this is true theoretically, it is hardly ever so practically; particularly with reference to the nitrogen, the most costly of the fertilizing elements.

In very few instances, unless the animals are pastured, is the urine saved to the soil, and this part of excreta contains the major part of the nitrogen.

The nitrogen in the manure is not by any means all available, at best not more than fifty per cent, and in many cases not even so much; owing to the carelessness in handling the dung. On this basis the fertilizing value of the manure would be about 80 cents (three fourths of the potash and phosphoric acid and one fourth of the nitrogen); this added to the value as a food, $1.58, increases the net value to $2.38, and the difference (73 cents) between this sum and the fertilizing worth, is fully made up in the green-manurial value of the vegetable matter in the tops.

It is thus seen that theoretically, at least, the tops are of equal value in whichever way they are used; therefore, it would be foolish for a man who did not own cows to buy them and burden himself with a new industry for the sake of using the beet tops economically. But for those who have animals a wise choice could be made by considering the general conditions of land, food, labor, etc., without regard to figures and values.

We must not forget in this connection that the sugar-beet tops *alone* will not constitute a balanced ration, or even approach it. They can only be used as a portion of the roughage food given to the animals.

On account of the bitter taste imparted to the milk by the beet tops, their use as a feed is not recommended in dairies supplying milk to be consumed as such.

It is claimed by some authorities that an excessive use of sugar-beet tops will prove injurious to the animals on account of the oxalic acid present; hence the conjoined use of lime in countries where the leaves are siloed.

Foxtail Hay (barley grass, *Hordeum jubatum*).—This hay is considered by the majority of feeders as anything but a first-class fodder. In addition to the lack of nutriment which is generally accredited to this feed, there are mechanical difficulties encountered in its use, as ordinarily fed, in that it injures the mouth and intestines of the cattle. Others again claim that if the hay is cut at the proper time, before it becomes too dry, and carefully cured, animals can eat it without injury, doing so with relish.

The analysis of a sample of this hay from Hanford, Tulare County, No. 79, Table I, proves it to be one of considerable value to the stockfeeder; comparing very favorably with the cereal hays, as indicated by the following table, showing the comparative values of foxtail, and wheat, oat, and alfalfa hays:

TABLE II. COMPARATIVE VALUES: PERCENTAGE COMPOSITION.

Hays.	Moisture.	Ash.	Protein.	Fiber.	Nitrogen-Free Extract.	Fat.
Foxtail	12.00	5.39	7.45	33.53	39.79	1.84
Alfalfa	10.95	5.43	17.60	22.63	39.31	3.08
Wheat	11.67	6.95	6.48	18.72	54.33	1.85
Oat	10.38	6.75	8.31	23.85	47.91	2.80

It will be noted from an examination of these figures, that while foxtail hay contains less than one half the amount of protein found in alfalfa, it is in this respect but little below that of oat, and ahead of wheat hay.

Wheat hay has a greater nutritive value than foxtail, owing to the latter having a much higher percentage of crude fiber, the digestion coefficient of which is low; and a lower content of starch possessing a high digestion-coefficient.

Foxtail hay is more closely allied in food value to oat hay than to either of the others mentioned in the table.

Siloing the foxtail is the most economical and efficient method of preserving the nutriment of this fodder. It can be mixed with alfalfa in the silo and the resulting product would have a higher food value than would either of the ingredients separately. In this way much valuable food material would be annually saved in place of being wasted, as is now done with the major portion of the foxtail grown in the State. At the same time no better means than the silo could be devised of ridding the ground, if so desired, of the foxtail, as it is placed in the silo in the green state, thereby preventing the reseeding of the soil with this material.

Eriogonum Parvifolium (common name "small-leaved joint weed"); No. 80, of Table I.—This is a valuable fodder for cattle frequenting sandhills in Santa Barbara County, as it remains green longer than any other herbage indigenous to the section. Cattle eat it with avidity. The sample analyzed, No. 80, was received from Mr. H. Dutard, San Francisco. In nutritive value it rates about equal to that of oat hay, but ranges higher in albuminoids and fat than does that fodder.

Corn Meal.—No. 81 of the table, received from a dairyman in San Francisco, has a lower content in protein and is therefore richer in starch than the averages 10.5 and 69.6, respectively, of some 200 analyses of this foodstuff made elsewhere.

Wheat Bran.—In considering the food value of the different mill products only the protein or nitrogenous ingredients should receive attention, because these concentrated foods are purchased with a view of supplying the deficiency in the ration of the flesh-formers. Therefore, the higher the percentage of albuminoids a food contains the more should it commend itself to the feeder.

Two analyses of wheat bran, Nos. 82 and 83, are given in Table I, the former rating in protein content below, and the latter above, the home average, 13.44, obtained for this ingredient.

No. 84, *Wheat Middlings*, showing no more than 12.50 per cent protein, is evidently not a representative sample, and would be subject to discount if a food control were exercised in this State.

No. 85, *Wheat Shorts*, is a high-grade material and of greater value to the dairyman than the wheat middlings represented by the analysis just noted.

No. 86, *Mixed Feed*, presents a very instructive and interesting lesson. When this food was first placed in the market many feeders stated that "Mixed Feed" was a lot of worthless stuff composed of the sweepings of the mill. The analyses, however, made at this laboratory have gone far to disprove that assertion.

The average of analyses of six specimens of this material previously made, is for protein 11.67 and the corresponding figure for the sample under consideration is 14.04; thus evincing on the part of some manufacturers, at least, a desire to act honestly and liberally with the customers.

Rolled Barley.—The analysis, No. 87, indicates that this ranges in nitrogenous content slightly lower than the highest grade of this material.

Rice Hulls.—This by-product (No. 88), while having a certain value for feeding purposes, cannot, on account of its low protein percentage (5.36), be classed among the concentrated foods.

Dried Blood.—Two samples of this food material for poultry were examined with reference to their content of protein. The results are noted below:

No.	Material.	Locality.	Protein.
85	Dried Blood	Petaluma	80.94%
86	Dried Blood	Aptos	78.13%

These figures prove that neither of the specimens analyzed are of the highest grade, which should yield about 85 per cent of crude protein.

Bean Meal, sent by a poultry-feeder in Petaluma. The sample upon analysis yielded: Crude protein, 23.81 per cent, approaching very closely the maximum obtained for this nutrient.

Macaroni Flour, from San Francisco. The material as it stands contains: Crude protein, 18.29 per cent, which exceeds the average obtained elsewhere for the same ingredient.

Pine Nuts, Piñones.—These nuts are used to a large extent by the candy manufacturers, and at present, in San Francisco, can only be obtained at such places. The retail price per pound is 30 cents.

In Table III are given the results of the examination of the sample received and also, for the sake of comparison, the analyses of some other nuts, and of cheese.

TABLE III. COMPARATIVE VALUES OF VARIOUS FRUITS.

	Walnuts*	Almonds†	Peanuts.	Pine Nuts.	Cheese, Full Cream.
Water	2.50	5.00	8.00	6.35	30.20
Ash	1.46	2.03	2.00	3.38	4.20
Protein	16.93	20.92	28.00	33.95	28.30
Fat	63.65	54.74	40.00	49.38	35.50
Fiber	2.33	3.07	22.00	1.34	1.80
Starch, etc.	13.13	14.24		5.60	
Total	100.00	100.00	100.00	100.00	100.00

* Average of five different varieties, California grown.
† Average of eleven different varieties, California grown.

From this showing it is noted that the pine nut is exceedingly rich in albuminoids; containing fully twice as much of this nutrient as is

found in the ordinary walnut, over 50 per cent more than that yielded by the almond, and nearly 25 per cent in excess of the protein content of peanuts and cheese.

It rates lower in fat than the walnut and almond, but higher than either the peanut or cheese.

SUGAR BEETS—SEASON OF 1897.

By M. E. Jaffa.

In the examination of sugar beets for the season of 1897, we were ably assisted by F. J. Snow, a student in the Agricultural Laboratory.

SACRAMENTO COUNTY.

Sugar Beets from Sacramento Chamber of Commerce, Nos. 316–355. The seed, furnished by the Watsonville Factory, was sown on different classes of soil, at various points in the vicinity of Sacramento. All of the lots were received in good condition, except Nos. 321, 322, 323, 328, and 329, which were very slightly wilted.

No. 316. Seed sown on alluvial soil, on Dry Creek, April 1st; harvested July 30th.

No. 317. Seed sown on sandy loam land, near Hop Town, April 1st; harvested July 30th.

No. 318. Seed sown on black loam soil, near Hop Town, April 1st; harvested July 30th.

No. 319. Seed sown on red clay soil, 5½ miles southeast of Sacramento, April 1st; harvested August 1st.

No. 320. Seed sown on brown clay soil, 3½ miles south of Sacramento, April 1st; harvested August 1st.

No. 321. Seed sown on red clay gravelly land, 15 miles east of Sacramento, April 1st; harvested August 10th.

No. 322. Seed sown on brown clay soil, 13 miles east of Sacramento, April 2d; harvested August 10th.

No. 323. Seed sown on red clay soil, 5½ miles southeast of Sacramento, April 10th; harvested August 10th.

No. 324. Seed sown on brown clay soil, 3½ miles south of Sacramento, April 5th; harvested August 10th.

No. 325. Seed sown on moist sediment land, 6 miles east of Sacramento, north side of American River, April 6th; harvested August 10th.

No. 326. Seed sown on coarse sediment soil, 7 miles east of Sacramento, April 6th; harvested August 10th.

No. 327. Seed sown on sandy loam soil, 8 miles northeast of Sacramento, April 7th; harvested August 10th.

No. 328. Seed sown on brown clay soil, 5½ miles south of Sacramento, April 15th; harvested August 14th.

No. 329. Seed sown on black loam soil, 1½ miles south of Sacramento, April 20th; harvested August 14th.

No. 331. Seed sown on sediment soil, 5 miles east of Sacramento, April 20th; harvested August 16th.

No. 346. Seed sown on sediment and peat land, 15 miles south of Sacramento, May 27th; harvested August 24th.

No. 354. Seed sown on sediment and peat land, 15 miles south of Sacramento, May 2d; harvested August 31st.

No. 355. Seed sown on sediment and peat land, Pierson reclamation tract, May 6th; harvested August 31st.

SACRAMENTO COUNTY.

Serial Number	Variety of Seed.	Average Weight, in Grams	Specific Gravity of Juice	Solid Contents by Spindle, per cent	Cane Sugar, per cent	Purity Coefficient	Ash in Juice, per cent
316	Watsonville seed	362	1.0880	21.00	18.46	87.90	.70
317	" "	900	1.0570	14.00	11.02	78.72	.95
318	" "	894	1.0770	18.60	15.76	84.73	.62
319	" "	481	1.0923	22.00	18.11	82.31	1.00
320	" "	242	1.0510	25.30	20.25	80.04	1.08
321	" "	480	1.0770	18.60	15.40	82.80	.81
322	" "	270	1.0954	22.70	20.56	90.50	.63
323	" "	476	1.0936	22.30	17.82	79.91	.90
324	" "	213	1.0996	23.60	20.18	85.50	.81
325	" "	451	1.0873	20.90	18.89	90.38	.78
326	" "	508	1.0691	16.80	13.78	82.02	.85
327	" "	591	1.0797	19.20	17.43	90.77	.65
328	" "	328	1.0904	21.60	17.17	79.49	.83
329	" "	312	1.0806	19.40	15.61	80.40	.96
331	" "	488	1.0850	20.40	17.64	86.47	.64
346	" "	625	1.0761	18.40	14.67	79.82	.84
354	" "	750	1.0766	18.50	16.31	88.17	.85
355	" "	1031	1.0434	10.80	7.79	72.18	1.04

The results of the examination of these beets are very satisfactory and encouraging.

Those of the lots Nos. 320, 322, and 324 contain upwards of 20 per cent of sugar, and in the latter two numbers high purity coefficient.

In three of the samples, Nos. 316, 319, and 325, the sugar content is between 18 and 19 per cent; and in Nos. 323, 327, 328, and 331 we find the sugar ranging between 17 and 18 per cent.

Four of the specimens, Nos. 318, 321, 329, and 354, are also rich, showing more than 15 per cent of sugar, with very fair purity coefficient.

With the exception of No. 317, of too low a grade to be accepted without discount by the sugar factories, and No. 355, yielding less than 8 per cent of sugar and a low purity coefficient, therefore entirely out of the question, all the lots received from the Chamber of Commerce would command a premium at the sugar factories.

No. 355 is the only case where the weight is in excess of what is desired in a high-grade beet.

Sugar Beets from Pierson Reclamation Tract, Nos. 368–372. Received in good condition from T. G. J. Van der Bosch, September 16, 1897:

Serial Number	Variety of Seed.	Average Weight, in Grams	Specific Gravity of Juice	Solid Contents, by Spindle	Cane Sugar, per cent	Purity Coefficient	Ash in Juice, per cent
368	Watsonville	542	1.0621	15.20	13.00	85.20	.60
369	"	1022	1.0617	15.10	13.23	87.61	.57
370	"	1050	1.0578	14.20	10.92	76.90	.71
371	"	820	1.0548	13.50	10.60	78.52	.69
372	"	516	1.0678	16.50	15.14	90.65	.59

The sugar content of Nos. 368 and 369 is very fair and the purity coefficient excellent. Nos. 370 and 371, each containing less than 11 per cent of sugar, have too low a rating to be accepted at par by the sugar factories. No. 372, however, with 15.14 per cent of sugar and 90.65 purity coefficient, is a high-grade beet in every respect.

Sugar Beets from Walnut Grove, Nos. 408–412; 415–419. Received in good condition from P. J. Van Loben Sels, Walnut Grove. The first group was harvested October 6th, the rest twelve days later.

Serial Number	Variety of Seed.	Average Weight in Grams	Specific Gravity of Juice	Solid Contents by Spindle, per cent	Cane Sugar, per cent	Purity Coefficient	Ash in Juice, per cent
408	Watsonville seed	422	1.0783	18.90	17.07	90.31	---
409	" "	359	1.0770	18.60	16.91	90.91	---
410	" "	380	1.0837	20.10	18.06	89.85	---
411	" "	355	1.0674	16.40	14.46	88.17	---
412	" "	384	1.0766	18.50	16.26	87.19	---
415	" "	289	1.0837	20.10	16.39	81.59	.62
416	" "	391	1.0810	19.50	16.81	86.21	.64
417	" "	450	1.0652	15.90	14.04	88.24	.41
418	" "	350	1.0748	18.10	16.49	91.12	.44
419	" "	342	1.0717	17.40	15.76	90.59	.50

The first lot of specimens arrived October 9th, and with the exception of No. 411 are excellent samples of high-grade sugar beets. They are exceedingly rich in sugar, are light weight, and the purity coefficients of all are high, but those of Nos. 408, 409, and 410 exceptionally so. While the rating of No. 411 is not up to that of the others of this group, still it would be entitled to a premium at the factories.

Commenting on the second lot of specimens received at the laboratory October 20th, eleven days later than the first consignment, we note that although the beets are all, excepting No. 417 with 14.04 per cent, very rich in sugar, yet there has been a deterioration in this respect, and also in the purity of the juice, by the beets remaining in the ground after October 6th. The averages of the two lots are 16.55 per cent of sugar with 89.43 purity and 15.89 per cent of sugar with 87.55 purity.

Sugar Beets from Tyler Island, Sacramento River, Nos. 413, 425, and 427. Sent by H. Voorman, of San Francisco.

Nos. 413 and 425. Kleinwanzlebner, seed sown May 15th, harvested October 7th and November 5th, respectively:

Serial Number	Variety of Seed.	Average Weight, in Grams	Specific Gravity of Juice	Solid Contents by Spindle	Cane Sugar, per cent	Purity Coefficient	Ash in Juice, per cent
413	Kleinwanzlebner	730	1.0536	13.20	9.53	71.64	.89
425	Kleinwanzlebner	762	1.0626	15.30	12.17	79.54	.96
427	Vilmorin Imperial	483	1.0739	17.90	15.33	85.65	.91

The result of the examination of No. 413, made in October, proves that while the weight of this beet is below the adopted standard of the sugar factories, the sugar percentage and the purity coefficient are both so low that the beet would not be salable except with heavy discounts. But the analysis of the same beet, No. 425, a month later, shows a decided improvement in the sugar content and purity coefficient, both reaching the limits set by the factories; thus indicating immaturity of the beet at the October harvesting.

No. 427. Vilmorin Imperial, sown May 15th, harvested December 15th. The sample was received in a somewhat wilted condition, December 20th. The high rating, as noted by the analysis, is probably due in part to the drying of the beet.

Sugar Beets from Galt, No. 414. Received in good condition on October 16th, from J. B. Duffy, Galt. Weight, 980 grams; specific gravity of juice, 1.0591; solid contents, 14.50; per cent of cane sugar, 12.7; purity coefficient, 83.92; per cent of ash in juice, 0.70. The sugar content and the purity coefficient are both fair; the weight is just within the desirable limit. This beet would be accepted at par by the sugar factories.

YOLO COUNTY.

Sugar Beets from Merritt Island, No. 353. Sent by the Sacramento Chamber of Commerce. Harvested in good condition, and received in good condition August 28th, 1897. The seed was furnished by the Watsonville factory. The weight was about $1\frac{3}{4}$ pounds; specific gravity of juice, 1.0835; solid contents, 20.10 per cent; per cent of cane sugar, 16.54; per cent of ash in juice, 0.83; purity coefficient, 82.28. The sugar content was quite high, but the purity coefficient only fair.

SONOMA COUNTY.

Sugar Beets from Healdsburg, No. 314. Received in excellent condition from W. N. Gladden, Healdsburg. Weight, 614 grams; specific gravity, 1.0591; solid contents, 14.50 per cent; cane sugar, 10.66 per cent; ash, 0.90 per cent; purity coefficient, 73.50. The sugar content and purity coefficient are both very low, due to the immaturity of the beet.

SANTA CRUZ COUNTY.

Sugar Beets from Watsonville, No. 426. Received from T. Therwatcher on November 19th, 1897, in a slightly wilted condition, which may account to some extent for the high sugar per cent, 19.40, and purity coefficient, 86.99, yielded by the beets. The average weight was 825 grams; solid contents, 22.30 per cent; ash, 0.90 per cent.

KERN COUNTY.

Sugar Beets from Famoso, No. 330. Received in good condition from the Stewart Fruit Co., August 16, 1897. Average weight, 1,000 grams; specific gravity, 1.0519; solid contents, 12.90 per cent; ash in juice, 1.07 per cent. These beets make an exceedingly poor showing. The sugar percentage, 6.91, and the purity coefficient, 53.56, being the minimum figures obtained for the season. The cause of this low rating is due, partially, to the large size, and also to the too early harvesting of the beet.

TULARE COUNTY.

Sugar Beets from Visalia. Five samples, Nos. 420–424, representing as many different varieties, were received in good condition on October 20th from J. Jacobs and Brother, Visalia.

Serial Number	Variety of Seed.	Average Weight, in Grams	Specific Gravity of Juice	Solid Contents by Spindle, per cent	Cane Sugar, per cent	Purity Coefficient	Ash in Juice, per cent
420	L. D.	784	1.0430	10.70	6.30	58.87	.97
421	K.	784	1.0639	15.60	11.85	76.00	.86
422	D. D.	735	1.0514	12.70	8.42	66.21	.96
423	F. D.	854	1.0464	11.50	7.50	65.21	.93
424		607	1.0523	12.90	9.72	75.35	.76

The results obtained from the assay of these beets are not all encouraging, and as these same varieties have yielded excellent returns elsewhere it would appear that, either the soil in which they were grown was not adapted to sugar beets (perhaps contained too much alkali), or that proper attention was not given to the after-cultivation, etc.

SUGAR BEETS FROM THE EXPERIMENT STATIONS.

Central Experiment Station (Berkeley, Alameda County), No. 315. Sample of sugar beets harvested and received in good condition from Economic Garden of the Station on July 28, 1897; having been harvested the same day. Average weight, 550 grams; specific gravity, 1.0630; solid contents, 15.40 per cent; cane sugar, 13.78 per cent; ash in juice, 0.69 per cent; purity coefficient, 89.50. This beet, although showing an excellent purity coefficient, 89.50, was somewhat immature and would have rated higher in sugar content had it remained longer in the ground.

Southern California Substation (near Pomona). Sixty-four samples of sugar beets, representing seven different varieties, grown on the ten-acre tract, were received at the laboratory during the season of 1897. The results of the analyses are presented in the table below.

Dates of Planting.

47 lots, Nos. 356–407 inclusive, were planted	April 28th.
11 lots, Nos. 332–345 inclusive, on	May 7th.
6 lots, Nos. 347–352 inclusive, on	May 25th.

Dates of Harvesting.

Nos. 332–341	August 21st.	Nos. 373–378	September 20th.
Nos. 342–345	August 23d.	Nos. 379–384	September 21st.
Nos. 347–352	August 25th.	Nos. 385–391	September 27th.
Nos. 356–361	September 7th.	Nos. 392–401	September 30th.
Nos. 362–367	September 8th.	Nos. 402–407	October 4th.

The majority of the samples were received in good condition. The exceptions were Nos. 379, 393, and 407, which were slightly wilted upon arrival at the laboratory.

Serial Number	Variety of Seed.	Average Weight, in Grams	Specific Gravity of Juice	Solid Contents by Spindle, per cent	Cane Sugar, per cent	Purity Coefficient	Ash in Juice, per cent
332	Dumesmay, France	542	1.0709	17.20	15.03	87.38	.84
333	" "	577	1.0652	15.90	13.20	83.01	.77
334	" "	229	1.0626	15.30	10.92	71.50	1.12
335	" "	562	1.0634	15.50	11.54	74.45	1.14
336	" "	337	1.0630	15.40	13.10	85.06	1.01
337	" "	600	1.0652	15.90	11.08	69.68	1.04
341	L. D.	225	1.0691	16.80	13.55	80.65	.77
342	D. D.	484	1.0621	15.20	11.20	73.68	.80
343	Vilmorin Française riche	450	1.0726	17.60	15.71	89.26	1.06
344	Kleinwanzlebner	455	1.0757	18.30	16.36	88.19	.76
345	Ameliorée Vilmorin	389	1.0837	20.10	18.12	90.14	.65
347	D—— Vilmorin	421	1.0643	15.70	12.48	79.49	.85
348	" "	435	1.0674	16.40	12.43	79.49	.84
349	" "	398	1.0634	15.50	12.59	81.22	.79
350	" "	415	1.0682	16.60	12.80	77.10	.84
351	O—— "	440	1.0669	16.30	12.30	75.46	.74
352	" "	545	1.0665	16.20	12.50	77.16	----
356	O. D—— Vilmorin	405	1.0832	20.00	17.02	85.10	.64
357	" "	473	1.0669	16.30	14.04	86.13	.65
358	" "	553	1.0674	16.40	14.04	85.60	.63
359	" "	672	1.0687	16.70	14.35	85.32	.79
360	" "	473	1.0730	17.70	14.98	84.07	.70
361	" "	573	1.0744	18.00	15.14	84.11	.74
362	" "	458	1.0730	17.70	14.96	81.01	.72
363	" "	679	1.0709	17.20	14.41	83.77	.74
364	" "	522	1.0639	15.60	11.70	75.00	.64
365	" "	472	1.0709	17.20	14.93	86.22	.60
366	" "	430	1.0691	16.80	14.04	83.57	.74
367	" "	593	1.0665	16.20	13.42	82.83	.69
373	" "	658	1.0775	18.70	14.15	75.65	----
374	" "	605	1.0757	18.30	14.31	78.19	----
375	" "	615	1.0761	18.40	14.04	76.30	----
376	" "	580	1.0700	17.00	13.57	79.82	----
377	" "	480	1.0753	18.20	14.62	80.33	----
378	" "	710	1.0819	19.70	16.86	85.60	----
379	" "	668	1.0700	17.00	15.61	91.24	----
380	" "	580	1.0695	16.90	14.36	85.00	----
381	" "	638	1.0700	17.00	14.67	86.29	----
382	" "	600	1.0726	17.60	14.80	89.83	----
383	" "	768	1.0700	17.00	14.83	87.23	----
384	" "	655	1.0674	16.40	13.89	84.70	----
385	" "	620	1.0700	17.00	14.36	84.47	----
386	" "	648	1.0744	18.00	15.61	84.38	----
387	" "	763	1.0660	16.10	13.08	81.24	----
388	" "	808	1.0691	16.80	13.08	77.85	----
389	" "	663	1.0674	16.40	12.40	74.42	----
390	" "	568	1.0621	15.20	15.22	80.41	----
391	" "	500	1.0788	19.00	16.43	81.21	----
392	" "	637	1.0660	16.10	12.60	78.26	----
393	" "	725	1.0730	17.70	16.73	94.51	----
394	" "	568	1.0717	17.40	14.43	82.93	----
395	" "	835	1.0630	15.40	12.30	79.87	----
396	" "	762	1.0656	16.00	14.33	89.56	----
397	" "	637	1.0761	18.40	15.92	86.52	----
398	" "	600	1.0674	16.40	14.02	85.47	----
399	" "	575	1.0647	15.80	14.04	88.88	----
400	" "	850	1.0643	15.70	13.39	85.31	----
401	" "	762	1.0704	17.10	14.12	82.58	----
402	" "	550	1.0621	15.20	12.89	84.86	----
403	" "	680	1.0717	17.40	14.22	81.75	----
404	" "	683	1.0674	16.40	14.20	86.58	----
405	" "	746	1.0665	16.20	14.57	89.95	----
406	" "	468	1.0717	17.40	15.71	90.29	----
407	" "	656	1.0674	16.40	14.82	91.01	----

The season's work may be summarized, as follows:

1. The maximum per cent of sugar, 18.12, with a purity coefficient of 90.14, was yielded by Vilmorin Ameliorée, No. 345, a light-weight beet, about 10 ounces.

2. The minimum sugar content and purity coefficient, 10.92 and 71.50 respectively, were obtained from No. 334, a small beet averaging one half pound.

3. The average percentage of sugar, 14.10, shows an improvement over that of the seasons of 1895 and 1896.

4. In no case does the mean weight of any sample exceed the standard adopted by the sugar factories; the maximum and minimum averages being respectively 28.3 and 7.5 ounces.

5. Considering that these beets were grown on alkali soils, averaging about 5,000 pounds of soluble salts to the acre, the results are very encouraging. If the beets had been raised on non-alkali soils the returns would undoubtedly have been higher.

5. FRUITS, VEGETABLES, TOBACCO, ETC.

CALIFORNIA APPLES.

By George E. Colby.

While the numerical list of apples examined is rather small, the results obtained are valuable, because they fill a gap in the record of systematic work of this Station on California fruits. Moreover, the samples represent, for the varieties tested, the product of widely distributed localities which are claimed as suitable for apple-raising.

The following is a description of the samples received and analyzed:

DESCRIPTIVE NOTES ON APPLES EXAMINED.

Pioneer, No. 1, grown at Franktown, Nevada, by Mr. Ross Lewers; location, near Washoe Lake; elevation, about 5,500 feet. This apple is a California seedling of medium size and very good quality; color greenish yellow. Although not as attractive as many other varieties, still an excellent keeper and a very desirable winter apple.

Esopus Spitzenberg. One lot, No. 2, grown by F. M. Whitmore, at an elevation of 4,000 feet, in the pineries of Amador County; another lot, No. 13, grown at Alviso, in Santa Clara County, not more than 50 feet above the sea level, name of grower not given.

Rhode Island Greening. One lot, No. 3, grown by F. M. Whitmore, as above; a second lot, No. 8, grown by J. C. Shinn, of Niles, elevation about 100 feet; a third lot, No. 12, grown in the Willamette Valley in Oregon, near the river, grower's name not known, apples selected from Allison & Co., San Francisco.

Fall Pippin, No. 4, grown in Amador County by F. M. Whitmore, as above; medium sized.

American Pippin, or *Grindstone*, No. 6, grown at Antelope Springs, in Amador County, elevation 5,000 feet, by Mr. Smith (initials not obtained). Fruit sent by J. W. Neal, foreman of the Amador substation. This is a rare and old variety seldom grown in the valleys, described by Thomas as "medium, roundish-oblate, regular, dull red, very hard, dry." It is always a long keeper. As grown in the mountains, its quality is much better than when valley grown. It has been known to keep until June.

Yellow Newtown Pippin. One lot, No. 5, grown by F. M. Whitmore, as above; the second lot, No. 9, by J. C. Shinn, of Niles. A third lot, No. 10, was purchased in San José, being selected from a shipment grown at Wright's Station, a good apple district, and was said by the dealer to be as good as any he had ever seen from that region. A fourth lot, No. 11, was grown in Amador County, at an elevation of 2,000 feet. near the Experiment Station, by Mr. Henry Griffin.

Swaar, No. 7. These were grown by F. M. Whitmore, as above. The Swaar is an old Pennsylvania apple, of very fine quality when well grown.

The Esopus Spitzenberg, American Pippin, Yellow Newtown Pippin, and Swaar, in the above lot, grown at the higher elevation, were better in appearance, firmness, and quality, commercially speaking, than those at lower elevations. The Rhode Island Greenings, grown in Oregon, were better in appearance than the other specimens of that variety.

DISCUSSION OF ANALYTICAL RESULTS.

The first part of this record, as tabulated, deals as heretofore for the other fruits, with the physical and proximate analyses; the second division treats of the ash and the fertilizers necessary to replace the vital soil ingredients taken away by the apple crop.

Size of Apples.—Barring accidents in taking samples, one point immediately strikes the eye as to the size of fruit examined, viz: that all of the varieties from Amador County grown at an elevation of 4,000 feet, are larger than those from other localities in California, for the Esopus Spitzenberg, No. 2, is nearly one-half again larger than the Spitzenberg from Alviso, Santa Clara County, elevation only 50 feet. Again, the Rhode Island Greenings from Amador are over one-fifth larger than the same variety from Niles, Alameda County, elevation 150 feet. It is, however, noticeable that the sample from Oregon, No. 12,* is considerably larger than either of the California-grown Greenings. Both lots of the Yellow Newtown Pippins from Amador, Nos. 15 and 11, are superior in size to those from Niles (No. 9) and from Wright's Station (No. 10).

It must be admitted from this showing that the claim that high foothills and mountain localities are best suited for apple-raising, is upheld so far as *size* of fruit is concerned.

Juiciness of Fruit.—The variety of apple yielding the greatest amount of juice, 85.72 per cent, is the American Pippin, No. 6, from Amador County. This is closely followed by the Pioneer, No. 1, from Nevada, with 83.40 per cent of juice—another fruit from high elevation. The Rhode Island Greening, No. 3, also from Amador County, with 82.45 per cent of juice, nearly equals these.

As against these high figures we note that the Esopus Spitzenberg, No. 13, from Alviso, and the Yellow Newtown Pippin, No. 5, from Amador, are the *driest*, as each bears only 75.0 per cent of juice; the majority of the apples carry only about 5 per cent more than this lowest figure.

In amount of juice in whole fruit the apple rates about even with the apricot and cherry; on the other hand, prunes, figs, and oranges are all drier.

Sugar in Whole Fruit.—Among the varieties of apples, and even in the same variety from different localities, we note (as for prunes, oranges, and figs) a rather wide range in sugar percentage. In this particular these fruits differ from apricots and cherries as far as has been determined.

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* Oregon apples have a high place in the markets.

ANALYSES OF CALIFORNIA APPLES; CROP OF 1897.

Table A. Proximate Analyses.

Number	Variety.	Locality and Elevation.	Grower.	Date of Receipt and Analysis.	Physical Analysis.			Analysis of Juice.				Proximate Analysis.			Whole Fruit.			Number
					Average Weight, in grams*	Pulp,† Pressed—per cent	Juice—per cent	Solid Contents by Spindle	Total Sugar	Cane Sugar	Acid in Terms of Sulfuric (SO_3)	Water	Organic Matter	Ash	Nitrogen—per cent in Fresh Fruit	Albuminoids, (Eq. to N. × 6.25)	Sugar—per cent	
1	Pioneer	Franktown, Nev.; 5,500 ft.	Ross Lewers	Dec. 7, 1897	192.3	16.20	83.80	14.70	12.53	3.43	.34	86.27	13.48	.24	.081	.506	10.49	1
2	Esopus Spitzenberg	Amador Co.; 4,000 ft.	F. M. Whitmore	Dec. 7, 1897	160.0	19.26	80.74	17.45	15.67	5.39	.38	83.84	15.86	.30	.081	.506	12.65	2
13	Esopus Spitzenberg	Alviso, Santa Clara Co., 50 ft.		Dec. 12, 1897	107.0	25.00	75.00	17.50	14.70	2.39	.16	85.41	14.37	.22	.083	.524	11.01	13
3	Rhode Island Greening	Amador Co.; 4,000 ft.	F. M. Whitmore	Dec. 7, 1897	192.5	17.55	82.45	14.90	13.15	4.16	.34	86.50	13.22	.28	.089	.555	10.84	3
8	Rhode Island Greening	Niles, Alameda Co.; 50 ft.	J. C. Shinn	Dec. 22, 1897	166.6	20.60	79.40	13.10	11.62	1.80	.23	91.42	9.37	.21	.067	.423	9.22	8
12	Rhode Island Greening	Willamette Valley, Oregon		Dec. 22, 1897	214.0	20.77	79.23	13.10	11.46	3.59	.19	88.43	11.40	.17	.058	.356	9.07	12
4	Fall Pippin	Amador Co.; 4,000 ft.	F. M. Whitmore	Dec. 7, 1897	217.0	20.00	80.00	15.40	14.36	6.03	.32	86.50	13.24	.26	.076	.460	11.49	4
6	American Pippin	Antelope Springs, Amador Co.; 5,000 ft.	Mr. Smith	Dec. 7, 1897	210.0	14.28	85.72	21.10	18.51	7.40	.55	83.30	16.47	.23	.072	.452	15.85	6
5	Yellow Newtown Pippin	Amador Co.; 4,000 ft.	F. M. Whitmore	Dec. 7, 1897	193.0	25.00	75.00	17.50	15.67	6.11	.36	85.00	14.77	.23	.110	.687	11.76	5
9	Yellow Newtown Pippin	Niles, Alameda Co.; 150 ft.	J. C. Shinn	Dec. 22, 1897	178.0	20.43	79.57	15.20	13.16	3.01	.17	85.19	14.49	.32	.130	.806	10.37	9
10	Yellow Newtown Pippin	Wright's Sta., Santa Cruz Co.		Dec. 22, 1897	138.5	20.45	79.55	16.60	15.15	3.92	.28	85.34	14.43	.23	.084	.525	12.06	10
11	Yellow Newtown Pippin	Jackson, Amador Co.; 2,000 ft.	Henry Griffin	Dec. 22, 1897	203.0	18.60	81.40	20.90	16.66	7.79	.41	85.60	14.23	.17	.058	.356	13.51	11
7	Swaar	Amador Co.; 4,000 ft.	F. M. Whitmore	Dec. 7, 1897	167.0	20.20	79.80	18.40	16.12	4.67	.26	86.29	13.45	.26	.074	.462	12.86	7

* About 30 grams are equivalent to one ounce. † Includes the rind.

A glance shows that the American Pippin, No. 6, from Amador County, elevation 5,000 feet, has the maximum sugar, 15.85 per cent, and with this is coupled the highest amount of acid in the juice, .55 per cent; thus, this fruit combines two essentials of a superior eating apple, viz: sweetness and tartness. The Yellow Newtown Pippin, No. 11, from Amador, rates next the highest, as it contains 13.51 per cent of sugar, over one half of which is cane sugar; and this, combined with its relatively high acid, in part explains why it is such a desirable variety.

The Swaar, No. 7, from Amador County, while rating high in sugar, 12.86 per cent, shows much less acid and only about one half as much cane sugar as does either of the Pippins just referred to.

By reference to Nos. 12, 9, and 13, it appears that the valley-grown apples from all localities usually run *lower* in sugar than those grown on higher lands. We cannot, however, lay any great stress upon this fact, because of the fewness of the samples studied. Nor can we say very much for the acid of these lots, although low acids uniformly prevail along with the low sugar content of the valley fruits.

Eastern apples* show in the juice of the Baldwin variety, 10.42, and in the Rhode Island Greening, 11.36 per cent of sugar. These figures, when referred to whole fruit, became, respectively, about 8.0 and 9.0 per cent. According to König,† European-grown apples average 7.22 per cent of sugar. California fruit from high elevations contains at least 4 or 5 per cent more of sugar than Eastern apples; and even the valley apples here have more sugar by 2 or 3 per cent than the European.

The following table of sugar percentages shows where the apple stands among California and European fruits, in this valuable constituent.

	Percentage of Sugar in Whole Fruit.	
	California.	European.
Grapes	20.70	14.40
4 Figs, White Adriatic	19.20	------
37 other Figs	8.0 to 19.20	11.50
13 French Prunes	18.53	------
23 Prunes, all varieties	15.35	6.2
3 Pears, Bartlett‡	14.43	------
3 Plums	12.89	3.6–7.0
2 Peaches	12.50	2.0–4.5
13 Apples	11.62	8.26
11 Apricots	11.10	10.0
80 Oranges	5.40	4.60

‡ Eastern Bartlett Pears have 7.12 per cent of sugar.

Nutritive Values; Nitrogen Contents.—The *maximum* nitrogen percentage, .130, corresponding to .806 per cent of albuminoids (protein), was found in the valley-grown Yellow Newtown Pippin, No. 9, but that in the same variety from Amador County stands very near it with .110 per cent of nitrogen, which corresponds to .687 per cent of protein.

The *minimum*, .056 per cent of nitrogen (.356 per cent protein), occurs in two lots, viz: in No. 12, Rhode Island Greening, and in No. 11, Yellow Newtown Pippin. All of the other nitrogen percentages are

*Mass. Agr. Expt. Station Report 1889, p. 302.
†Vol. II, p. 815.

readily seen to be about .07 or .08, corresponding to about one half of one per cent of protein.

The small table given below shows how the edible portions of the different fruits examined in this laboratory stand in protein, or *flesh-forming ingredients.* Some Eastern and European data are added for comparison:

Percentage of Protein, 100 Fresh Flesh, *i. e.*, in the Edible Portion of Fruits.

		Protein.
Apples—	California	0.52
	Eastern	.40
	European	.38
Pears—	California	.56
	Eastern	.60
	European	.38
Figs—	California	1.52
Oranges—	California	1.03
Apricots—	California	1.17
Prunes—	California	.89
Plums—	California	1.05
Nectarines—	California	.69

Figs, the heaviest bearers of protein, contain nearly three times as much of this essential ingredient as do either apples or pears, and one half again as much as apricots, plums, and oranges, which stand next to the fig. Prunes and nectarines stand just between the oranges, apricots, and plums, on one hand, and apples and pears on the other, in protein.

Percentage Composition of the Ash of Apples, and Nitrogen Content.

Total Ash.—Apples (and pears) as far as examined withdraw from the soil very much less mineral matter than do any of the other orchard fruits, averaging only .264 per cent of *ash* in the whole fruit (pears, .250), while prunes have been found to average .486 per cent, plums .535 per cent, apricots .508 per cent, oranges .432 per cent, lemons .526 per cent, cherries .482 per cent, and grapes .500 per cent of ash.

Components of the Ash.—The ash of apples averages over one half of *potash*—not unlike the other fruits—still the analysis shows for ash rather more variation in this ingredient than has usually been noticed in our fruits in general. The same remark is to be made as to variability in quantity of phosphoric acid, the next largest and most important ingredient. But on the average this amount is found to be much like that contained in the ash of oranges, figs, and apricots, which hold upwards of 12 per cent of phosphoric acid; as against 21.24 per cent for the grape, 15.1 per cent for the cherry, and 14.1 per cent of phosphoric acid for the prune. As to *lime*, the apple ash shows very considerable variation in percentages; in the average, however, this is about 4 per cent; very similar amounts are found in the ash of cherries, apricots, prunes,

TABLE B. ANALYSES OF THE ASH.*

Number	Variety.	Pure Ash	Potash	Soda	Lime	Magnesia	Peroxid of Iron	Br. Oxid of Manganese	Phosphoric Acid	Sulfuric Acid	Silica	Chlorine	Total	Oxygen Due to Chlorine	Total
	Yellow Newtown Pippin—														
5	Amador County; 4,000 ft.	.236	48.46	22.39	2.42	3.69	.34	1.04	16.80	3.79	.64	.48	100.05	.10	99.95
9	Niles; 150 ft.	.325	56.18	2.63	8.47	7.47	1.53	3.01	12.52	4.83	2.63	.87	100.14	.19	99.95
10	Wrights; 2,000 ft.	.232	60.99	10.07	3.50	4.53	.53	1.50	9.17	5.24	3.50	1.16	100.19	.25	99.94
	European Apples	1.44	35.68	26.09	4.08	8.75	1.40	-------	13.59	6.09	4.32	-------	-------	-------	-------

*By L. M. Tolman, Graduate Student in the Agricultural Department.

and grapes. The ash of oranges and lemons contains about five times more lime than that of the apple.

The quantity of *soda* in the ash of apples is also extremely variable, more so than noted for any other fruit so far studied. Previously, a range of from 1.7 to 10.26 per cent of soda was the largest difference noted, but in Table B we find that this ingredient varies from 2.63 to 22.39 per cent.

European analyses show a very much larger quantity (between four and five times as much) of total ash than we have found for California apples. In the foreign-fruit ash the *potash* content is very much less than in the California—in one case about one half the amount.

From the figures given in Tables A and B and in earlier reports relating to various fruits we have calculated the amounts of the several important soil ingredients held in 1,000 pounds of the various fruits in fresh condition. The results are given in the following table:

THE SOIL INGREDIENTS HELD BY 1,000 POUNDS OF FRESH FRUIT.

Fresh Fruit. (Crop of 1,000 pounds.)	Total Ash.	Potash. (K_2O)	Lime. (CaO)	Phosphoric Acid (P_2O_5)	Nitrogen. (N)
	lbs.	lbs.	lbs.	lbs.	lbs.
Almonds	17.29	9.95	1.04	2.04	7.01
Apricots	5.08	3.01	.16	.66	1.94
Apples	2.64	1.40	.11	.33	1.05
Bananas	10.78	6.80	.10	.17	.97
Cherries	4.82	2.77	.20	.72	2.29
Chestnuts*	9.52	3.67	1.20	1.58	6.40
Figs	7.81	4.69	.85	.86	2.38
Grapes	5.00	2.55	.25	.11	1.26
Lemons	5.26	2.54	1.55	.58	1.51
Olives	13.50†	9.11	2.43	1.25	5.60
Oranges	4.32	2.11	.97	.53	1.83
Peaches	5.30	3.94	.14	.85	1.20
Pears	2.50	1.34	.19	.34	.90
Prunes, French	4.86	3.10	.22	.68	1.82
Plums	5.35	3.41	.25	.75	1.81
Walnuts*	12.98	8.18	1.55	1.47	5.41

*Including hulls.

†This figure, *13.50 pounds total ash*, was obtained from California olives, and is given to correct the previously accepted amount, 94.63 total ash, calculated from a European analysis, in which a misprint caused the amount of *silica* to appear to be 80.77 pounds, whereas it was really only 1.05 pounds. This is quite in accordance with that which was found in our olives, viz: 1.02 pounds silica per 1,000 pounds fresh olives.

The figures found for apples (and pears) are, on the whole, so much smaller than those which have been obtained for the other ordinary orchard fruits, that it would seem safe to conclude that here fertilizers will not be necessary for apple crops for many years to come. However, the figures do indicate that the first need will be for a nitrogenous fertilizer, and this is about what this Station has been led to recommend for most of our fruits. Along with this need will also come that for a phosphatic fertilizer. There is no reason to supply *potash* to apple orchards for a great many years to come. The rather high quantity of sulfuric acid in the ash of apples, like that of the ash of cherries and oranges, indicates the occasional need of a dressing of gypsum to the soil, which not only supplies the necessary sulfuric acid, but helps to make the potash present more available.

NICOTINE IN CALIFORNIA-GROWN TOBACCOS.

By George E. Colby.

These determinations of nicotine in California tobaccos are only a preliminary step in the work of investigation and at best give but a clew as to what may be developed relating to this alkaloid in them.

To explain the record of analysis and show its practical value is the purpose of this article. To do this it is necessary to present some facts from other works on the analysis of tobacco, and the study of the various relations between the different constituents; both of which lines of investigation are practically but just begun. The tobacco expert with all his knowledge governing the judgment of tobacco does not recognize the nicotine content, as such, to be of value in his business.

Nicotine is the active principle of tobacco upon which its peculiar action depends; to it the narcotic and intoxicating qualities of the leaf are mainly due. Its flavor and characteristic odor are supposed to be due to a volatile substance named Nicotianine ($C_{23}H_{32}N_2O_3$), which has the consistency and appearance of camphor.

Distribution and Use of Nicotine in the Tobacco Plant.—Investigators have shown that nicotine is present in the tobacco plant from the time it begins to grow in the seed-bed until it has reached maturity and has gone through all the fermentative changes incident to curing, sweating, and manufacture. Every organ from the minute rootlet to the mature seed contains some trace of this alkaloid.

Once this poisonous principle has been formed it seems that it is of no further use in the nutrition of the plant. It is described as remaining useless in the economy of nature, only to satisfy a cultivated desire in the appetites of man.

Variation of Nicotine in the Different Parts of the Tobacco Plant.—F. B. Carpenter, of the North Carolina Agricultural Experiment Station*, found, from recent analyses made there of the different portions of the plant taken at different stages of growth, "that the percentage of nicotine varied greatly in the different parts. This variation increased as the plant reached maturity.

"In the young plant, the roots contain a slightly larger percentage than the leaves, but in the process of growth the percentage in the leaf very soon exceeds that of any other portion of the plant and continues to increase until, at maturity, the nicotine present there was found to be about 3⅓ times greater than that in the roots, or 3.09 per cent as against .90 per cent.

"Some variation in nicotine was noted in the roots, stalks, and stems during the stages of growth, but these were by no means so marked as in the leaves. Just as the leaf reached maturity the nicotine was at its maximum, therefore it would seem that the formation and accumulation of nicotine in the leaf continues just as long as there is any life in the plant. After growth ceases, whether the leaf remains on the stalk or whether it is subjected to the process of curing, it undergoes certain changes which alter its character and probably decompose a small part of the nicotine."

*Bulletin 122, p. 348 et seq.

Comparisons of Nicotine with Other Nitrogenous Components of Tobacco.—"Some comparisons of the percentage of nicotine with the total and nitric nitrogen existing in the different parts of the tobacco plant at different stages of growth, are given from analyses made in North Carolina. It was found that a large percentage of nitrogen in the leaf is accompanied by a relatively large percentage of nicotine, in proportion to the age of the plant.

"In the early growth the albuminoid nitrogen in the leaf is very large, that of nicotine is comparatively low; and as the plant continues to grow, the albuminoid nitrogen decreases and the nicotine increases, until at maturity these two substances reach their two extremes.

"This, with the fact that the nitric nitrogen is all present in the young growth, would indicate that the nicotine, instead of taking its nitrogen directly from the nitric acid, withdraws some or all of it from the albuminoids. If this be true, it is still difficult to tell what transformations take place in the development of this alkaloid, and also what conditions are favorable to its production."

The percentage of nicotine (in the whole leaf) of tobaccos grown in the United States ranges from 1.96 to 5.53. (See table for wider ranges in foreign tobacco.)

No doubt the differences in varieties partly account for these variations; but whatever variety is grown, or what other conditions prevail, it is always noticed that those influences which tend to produce a coarse, rank growth, containing a large percentage of albuminoids, also produce a comparatively large amount of nicotine.

"Of all the conditions of climate, soil, fertilizer, and after-treatment which influence the crop, those of soil and fertilizers seem to be the most important. A rich, heavy soil, fertilized with a strong nitrogenous manure, is very favorable to the production of nicotine in large quantities; the reverse is true of a light, sandy soil, containing little organic matter."

Development of a Large Nicotine Content Not Conducive to High Quality in Tobacco—"As nicotine is the active principle of tobacco upon which the stimulating effect depends, it would naturally appear that its development to a high degree would be desirable, but such is not the case. Those tobaccos considered as having the best qualities almost always contain a small percentage (No. 2, Fla. table), while a high percentage usually indicates coarseness.

"Certain conditions then are conducive to the development of nicotine; others that occur in the sweating of tobacco seem sometimes to materially reduce the amount of nicotine in the finished article."

Some researches made at the Connecticut Experiment Station by Dr. E. H. Jenkins* show that the loss in nicotine during sweating varies from one sixth to one half of the total amount. Behrens, a German investigator, states that, while there is no loss of nitrogen, yet one third the nicotine disappears—possibly as a food for lower organisms. For these reasons it seems that the nicotine of finished tobacco may be appreciably less than in the green plant, so that the analyses of these typical tobaccos cannot be said to give the exact amount of nicotine produced by certain conditions on the field.

*Conn. Agr. Expt. Sta. Ann. Rep., 1891.

The essential property of a good smoking tobacco is that it will hold fire after being ignited—a property largely governed by the composition of the ash-ingredients. Nicotine plays no part or has no influence in this important quality of tobacco.

Varieties Tested.—The specimens of tobacco examined at this Station for nicotine were grown on the experimental plot in the University Garden. The soil had been fertilized with kainit and stable manure in previous seasons.

The seed from which these samples were grown came from two sources—Louisiana, and the United States Department of Agriculture; and the tobaccos represent, in part, some of the newer varieties much prized in the Southern tobacco States. For instance, Nos. 2 and 6, Vuelta Abajo and Sumatra, give promise of supplanting the original Sumatra in the market of this country. Killebrew and Myrick* say: "The cigar trade has been considerably depressed since the advent of Sumatra wrappers; this leaf has no better appearance than the best American wrappers and is destitute of quality or aroma, but it is used because it is light and thin, only two pounds of it being required to wrap one thousand cigars; whereas from four to ten pounds of American leaf are needed to cover that number of cigars, owing to the heavier weight of domestic wrappers, which however are superior in other respects."

In part, these varieties represent some widely grown and much prized tobaccos: No. 8, White Burley, for mild chewing and smoking, plug and fine cut; No. 1, Hester, yellow tobacco, smoking; and No. 3, Little Orinoco, for manufacturing purposes. The remainder belong to the class of Domestic Cigar Tobacco.

These samples were cured, but not sweated; consequently, they show very nearly the content of nicotine they carried on the field. On the other hand we know that the finished tobaccos listed in the large table have lost some of their original nicotine. Therefore, from the figures given in the tables we cannot draw close comparisons or reach any very decisive conclusions. Moreover, the varieties reported in the two tables are mostly different.

Two general classes comprise the tobacco varieties given in the little table: one the chewing and the other the smokers and cigar tobaccos, whether they be best suited for wrappers, fillers, or binders.

The terms "class," "type," and "grade" in the tobacco trade have certain significance. Thus, the basis of a class is its adaptation for a certain use; the basis for a type is the combination of certain qualities or properties in the leaf, as color, strength, and elasticity. Grades represent the different degrees of excellence in a type, as lugs, lower leaf, medium, good, fillers, binders, or wrappers.

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* Tobacco Leaf, p. 379.

TABLE I. Analyses of California-Grown Tobaccos.

No.	Variety.	Usual Use.	Nicotine; Per Cent in Water-Free Substance.
1	Hester	Plug, wrappers, fillers, and smokers	6.47
2	Vuelta Abajo	Cigar and wrappers	2.23
3	Little Orinoco	Plug, chewing, and smoking	6.94
4	Partidas	Cigar	5.93
5	Comstock Spanish	Cigar	6.67
6	Pano de Sumatra	Cigar-wrapper	9.03
7	Brazilian	Cigar	4.82
8	White Burley	Plug, wrapper, and chewing	7.70
9	Conqueror Louisiana	Cigar	4.51
10	Connecticut Seed-leaf	Cigar	5.17
11	Remedios	Cigar	8.30

Cigar Tobaccos.—Turning our attention now to the class of cigar tobaccos in the small table, and gauging them from the nicotine-content, we immediately note the wide discrepancy—the maximum difference 6.8 per cent of the small series—between Vuelta Abajo (No. 2) with 2.23, and Sumatra (No. 6) with 9.03 per cent of nicotine. It appears that they bear out their Eastern reputations in California also. In Florida, the Vuelta Abajo is giving great promise. We find it, as grown in California, to contain even less (.40 per cent) nicotine before sweating than is reported in sample No. 2, from Florida (2.40). That from Florida (No. 2) represents the highest-priced tobacco in the table, and worth from $2 to $4 a pound. This result is encouraging.

Sumatra (No. 6), with 9.03 per cent of nicotine, leads all the determinations before us—and this in the variety said to be destitute of quality; however, we note that the original Sumatra analyzed elsewhere shows only 2.38 per cent of nicotine.

The Remedios (No. 11) of the Spanish cigar tobaccos, with 8.30 per cent of nicotine, cannot lay much claim for quality as produced here.

The remaining Spanish tobaccos, Partidas (No. 4), Comstock Spanish (No. 5), and Brazilian (No. 7), range some 2 to 4 per cent lower in nicotine than the Remedios. The Partidas and Comstock Spanish, after allowing for loss of nicotine in fermentation, are still rather higher (about 1 per cent) than the Spanish tobacco No. 26, from Tennessee, with 3.73 per cent, and No. 15 from Ohio with 3.33 per cent of nicotine.

But the Brazilian (No. 7), with 4.82 per cent, makes by far the most superior showing among the Spanish type of tobaccos here, and compares well in nicotine content with the Ohio and Tennessee Spanish.

The Connecticut Seed-leaf has a wide use in the tobacco trade in this country, and usually commands a high price. With us this variety (No. 10) shows 5.17 per cent of nicotine; a figure which may be materially lowered by allowing for loss in after-treatment, when it should become about 4 per cent. This is not far above the nicotine in the Connecticut-grown tobacco, Havana Seed-leaf (No. 8), with 3.36 per cent. In New York (No. 1) Havana Seed-leaf contains 1.96; in Massachusetts (No. 5), 3.56, and from foreign analyses as high as 3.98 per cent of nicotine. Dissimilarity of varieties makes this a hampered comparison, but we may safely conclude that our sample indicates success for it here.

Conqueror Louisiana (No. 9), with only 4.51 per cent of nicotine be-

fore sweating, may easily be called a success, for with 3.3 per cent after sweating it compares favorably with some of the Northern typical cigar tobaccos (see Nos. 5–8) and even better than some of them, No. 12 from Virginia and No. 24 from Illinois.

Comparison with Tobacco of Other States.—In order to properly compare the above tobacco varieties with those grown in tobacco-growing regions, the following table is made to give the results obtained at the North Carolina Experiment Station (Bulletin 122):

TABLE II. Typical Tobaccos of the United States Analyzed at the North Carolina Experiment Station.

Number and State.	Variety.	Manufactured Form, and Price per Pound.		Nicotine; Per Cent in Water-Free Substance.
1. N. Y.	Havana	Cigars, wrappers, and binders	$0 30	1.96
2. Fla.	Leaf Wrapper	Cigar	$2 00—4 00	2.40
3. Ky.	London Strip	Export "shag"	10	3.54
4. Ky.	White Burley	Plug, fine cut, and smoking	10	4.65
5. Mass.	Hybrid Havana	Cigar-wrapper	20	3.56
6. Tenn.	German Spinning Leaf	Twist, chewing	09	5.53
7. Penn.	Seed Leaf	Cigar, wrappers, and fillers	20	1.45
8. Conn.	Havana Seed Leaf	Cigar, wrappers	50	3.36
9. N. C.	Bright Yellow Tobacco	Plug	45	2.76
10. Va.	Bright Wrapping Leaf	Smoking	25	2.20
11. Va.	Austrian Wrapper	Cigar and plug	10	3.02
12. Va.	Italian Regie	Cigar-wrapper	14	4.35
13. Va.	French Regie	Snuff	07	4.05
14. Va.	Mahogany Wrapper	Wrapper, plug, and twist	40	3.82
15. O.	Ohio Spanish	Cigar	11	3.33
(O.	Little Dutch	Fine smoking	----	.63)
16. Va.	Small Dark Wrapper	Plug and twist	17	5.33
17. Md.	Maryland Leaf Tobacco.	Smoking	----	2.51
18. O.	White Burley	Plug, fine cut, and smoking	20	2.60
19. Ga.	Yellow Tobacco	Smoking	----	2.04
20. Ala.	Yellow Tobacco	Smoking	----	4.41
21. Kan.	Kansas Tobacco		----	4.37
22. Miss.	Mississippi Tobacco		----	3.27
23. W. Va.	White Burley	Plug and smoking	----	3.40
24. Ill.	Illinois Seed Leaf	Cigars	----	4.38
25. Ind.	Indiana Tobacco		----	4.31
26. Tenn.	Spanish Type		----	3.73
27. N. C.	Bright Wrapping Leaf	Plug, wrappers, and smoking	----	2.72
28. N. C.	Bright Wrapping Leaf		----	2.37
29. N. C.	Mahogany Wrapper	Plug	----	2.50

Foreign Tobacco.

Place of Production.	Nicotine; Per Cent in Water-Free Substance.
Havana	2.0 —3.98
Sumatra	2.38
Java	3.30
Japan	1.89—3.92
French	5—8
Italian	1.62—5.99

Selecting the only variety named in both tables—the White Burley—we find that No. 4, from Kentucky, shows 4.65 per cent, that from Ohio, No. 18, 2.60 per cent, and that from West Virginia, No. 23, 3.40 per cent

of nicotine, as against 7.70 per cent of this ingredient in the sample grown in California. Now, making all allowances for this last as being only an individual result, and for loss in nicotine (were it sweated), it still would be a very high return, and would indicate a grade unsuitable for fine manufactured articles. Possibly it might suit the taste of those who require something very strong in the line of chewing tobacco. Some chewing tobaccos are actually found to contain 6 per cent of nicotine.

The Hester (No. 1) may be compared with the yellow tobaccos, as it is, practically speaking, one of them. In North Carolina (No. 9), these yield 2.76; in Georgia (No. 19), 2.04, and in Alabama (No. 20), 4.41 per cent of nicotine. In California the Hester, a variety belonging to the same type, shows 6.47 per cent of nicotine. Applying the arbitrary allowance for loss in the sweating process, our sample would still be much over the maximum given for this kind of tobacco. Little Orinoco (No. 3), a manufacturing tobacco, with 6.94 per cent of nicotine, makes a somewhat better showing than the White Burley, with its 7.70 per cent of nicotine. After fermentation, this 6.94 per cent of nicotine would in all probability become reduced to a little over 5 per cent ($6.94 - 1.7 = 5.2$), a figure which approximates that yielded by that of Virginia (No. 16), viz: 5.33 per cent.

This is a somewhat unsatisfactory comparison, but we think it indicates a little more promise for the Little Orinoco in California than would be expected for the Burley or Hester.

Conclusion.—In so far as the nicotine goes, the evidence, on the whole, seems to point to the conclusion that the cigar-leaf tobaccos grown here, at least, give promise of success.

Those engaged in tobacco culture in California turn mostly to the growing of cigar-leaf tobaccos, and they make the claim that their products are of good quality. This is true, if we are to base our judgment upon such samples as we have been able to obtain.

THE NUTRITIVE VALUE OF DESICCATED VEGETABLES.

By M. E. Jaffa.

It is many years since prospectors, soldiers, pioneers, etc., realized the necessity of a very careful selection of foods, as their vocation compelled travel in districts, generally mountainous, far removed from open market, and where every pound carried had to be thoughtfully considered. The natural tendency was, and is at present, to choose those substances which combine the maximum of nutriment with the minimum of weight, such as dried and smoked meats, beans, cereal meals, etc. All food materials containing appreciable per cents of water were omitted, on account of the expense attending the freighting of so much inert matter. In other words, concentrated foods were singled out, and the more concentrated the article the better was it considered.

In fact, at one time a theory was advanced that if the amount of nutriment required per day could be condensed in the form of tablets, pills,

etc., and consumed by man, the system would be properly nourished and a great saving of money and trouble in the matter of freight alone would thus be effected for the traveler. But science and practice have clearly demonstrated how irrational is such a theory. Experiments have been conducted with anything but satisfactory results, both in the case of human beings and domestic animals.

The necessity of there being a certain bulk in the daily food consumed either by man or animals, has been proven beyond question. To supply this bulk by concentrated foods would sooner or later tend to a derangement of the digestive functions and a general lowering of the body vitality. This would be due to the consumption of a greater amount of nutriment than that called for by the needs of the system.

The presence of an excess of fat or carbohydrates would tend to the formation of too much fatty tissue, which is not generally desired. But when an undue amount of nitrogenous matter is consumed the case is very different. The disproportion of nitrogen over and above that required in the adult to repair the nitrogenous wastes, must be eliminated from the system, and this removal causes overwork and strain on liver and kidneys. In addition to this, however, we have as another result of the overplus of nitrogen, the production of uric acid and allied compounds in the body, producing varied and, at times, serious troubles, as ably and scientifically set forth by Dr. Haig.

We thus see the need of some food materials concentrated in form so as to admit of its economical transportation, but at the same time, such that upon the addition of water and heat will create bulk without too much nutriment. This urgent want is most admirably supplied by the best or first quality of desiccated vegetables, lately placed on the market, which will prove in the future as great a boon to campers, miners, pioneers, mariners, etc., as have dried fruits in the past.

When properly prepared and the water removed at as low a temperature as possible, there is very little, if any, loss of nutriment; and the resulting product is savory, wholesome, and a most excellent addition to the foods now used by all people who cannot obtain fresh vegetables. Upon treating these materials with water and heat we attain the same end as if we had at our command the fresh article.

In the spring of 1898 four samples of desiccated vegetables—three of potatoes and one of carrots—were analyzed with the assistance of George E. Colby at the Station laboratory. The results are tabulated below.

No. 1, sliced California potatoes, unbleached, requiring soaking and cooking previous to table use.

Nos. 2 and 3, respectively California and Eastern prepared potatoes, ready for eating after being heated with the requisite amount of water.

No. 4, sliced California carrots, demanding similar treatment to No. 1 before being consumed.

TABLE I. Analyses of Desiccated Vegetables.

	No. 1.	No. 2.	No. 3.	No 4.
	Sliced California Potatoes (Unbleached).	Prepared Potatoes.		Sliced California Carrots.
		California.	Eastern.	
Moisture	7.93	8.70	4.80	3.50
Ash (mineral matter)	3.58	2.66	3.07	4.92
Crude Protein	7.27	8.70	9.50	7.70
Crude Fat	.45	.43	.40	3.55
Crude Fiber	1.50	1.65	1.65	7.95
Nitrogen-free Extract (starch, sugar, etc.)	79.27	77.86	80.58	72.38
Totals	100.00	100.00	100.00	100.00
Nutritive ratio	1:11.2	1:9.3	1:8.7	1:11.4
Fuel value of one pound (calories)	1,658	1,659	1,723	1,795

An examination of these data show that the materials as they stand are valuable articles of diet. When it is remembered that the percentage of water in the fresh potato is about 80, and that of carrots almost 90, the extent of concentration can better be appreciated.

The main ingredient is starchy matter, and this is in accordance with the analyses of fresh vegetables. The protein content of Nos. 1 and 4 rate nearly as high as in the best California white flour, as is seen by referring to the analyses of this substance: Water, 13.81; protein, 7.90; fat, 1.39; carbohydrates, 76.4; ash, .47.

It must not be forgotten, though, that while chemical analysis shows the two materials to be in this respect somewhat similar, the physiological action is different. The digestive coefficients for the vegetables are lower than those for the flours, and therein lies another advantage of the former, in that some of the bulk they furnish is not assimilable. As is well known, a certain portion of our food is not assimilated, and the same be said for animals—in the case of the cow, about one half of her daily ration is not taken up by the system.

The nutritive ratio of the vegetables is very wide, thus showing the materials to be carbonaceous, and not capable, to any extent, of supplying the nitrogenous portion of the daily food.

In order to better compare the materials cited in Table I, they have been calculated to a water-free basis, and the results presented in Table II; also the analyses of fresh Eastern potatoes and carrots similarly calculated.

TABLE II. Analyses of Desiccated Vegetables Calculated to a Water-Free Basis.

	No. 1.	Potatoes, Eastern.	No. 2.	No. 3.	No. 4.	Carrots, Eastern.
Ash	3.89	4.74	2.91	3.23	5.10	9.32
Crude Protein	7.89	9.95	9.54	10.00	8.00	9.32
Crude Fat	.50	.47	.47	.42	3.66	3.39
Crude Fiber	1.63	84.84	1.80	1.73	8.24	77.97
Starch, Sugar, etc.	86.09		85.28	84.62	75.00	
Total	100.00	100.00	100.00	100.00	100.00	100.00
Nutritive ratio	1:11.2	1:8.6	1:9.3	1:8.7	1:11.4	1:9.2
Fuel value of 1 lb. (calories)	1,799	1,765	1,717	1,810	1,851	1,766

From the above showing it appears that the protein content (flesh-forming ingredients) is uniformly higher in the Eastern vegetables than that yielded by the California product; hence the narrower nutritive ratio. The same is true regarding the flours of this State. The home product contains more starch, etc., than is noted for the Eastern article, while the fat percentages are practically equal.

An interesting point brought out by these tables is the large amount, comparatively, of mineral matter contained in the vegetables. While it is true that all of this is not assimilated, nevertheless that portion which is absorbed by the system is very necessary and proves additionally the value and importance of this class of foods.

The total food-values as shown by the potential energy, expressed in calories, of the potatoes under discussion, differ but little, as the California vegetables are richer in starch, though poorer in albuminoids. The higher rating in this respect of the California carrot is due to its lower mineral content.

Bleaching of vegetables is not to be recommended, because, in the first place, it is not necessary for preservation, and secondly on account of the injurious effect to the digestive organs of any and all bleaching agents, portions of which are to a greater or less extent incorporated in the material acted on.

EXAMINATION OF CANNED FRUITS.

Amount of Sugar in Canned Fruit for Which the Government Should Grant a Drawback When the Goods are Exported.

By George E. Colby.

In presenting claims to the Government, in accordance with Treasury regulations relating to drawback allowed for cane sugar used in canned fruits for export, California fruit-canners found it impossible to establish a definite statement as to the amount of cane sugar in these goods that would be subject to such regulations. Their claim was rendered imperfect for the reason, as they stated, that no analytical means existed by which could be shown the cane sugar which they knew they had used with the fruit. The reason for this apparent disappearance of cane sugar in canned fruits is fully explained by Professor Hilgard in his report which follows.

The California fruit-canners submitted to this department two samples of canned apricots; one, called the "Water sample," to which no sugar was added in manufacture; the other, marked "Cutting's," had sugar added to it in known quantity. The canned apricots were sound and apparently manufactured from ripe fruit. The "Water sample" not marked, contained 2.02 pounds, and the other marked "Cutting's" contained 2.12 pounds of canned material.

For comparison there is given the sugar in eleven samples of fresh flesh from apricots grown in Alameda, Contra Costa, Fresno, San Luis Obispo, and Los Angeles counties.

ANALYSES OF CANNED APRICOTS SENT BY THE CALIFORNIA FRUIT-CANNERS.

Sugars.	Canned Apricots 1897. Samples Sent by J. F. Evans.		Flesh of Fresh Apricots Cooked in Their Own Juice. Samples Examined at Cal. Expt. Station, 1891 and 1892.
	"Water Sample," No Sugar Used. No Mark.	Sample to Which a Measured and Determined Amount of Cane Sugar was Added at Time of Manufacture, Marked "Cutting's."	
Cane	.82%	8.28%	4.91%
Fruit and Grape	5.50	14.70	6.78
Total	6.32	22.98	11.69

SUGAR OF FRESH APRICOT FLESH: CALIFORNIA FRUIT.

Variety.	Locality.	Total Sugar.	Reducing Sugar.	Cane Sugar.
Hemskirke	Central California	11.27%	6.66%	4.61%
Blenheim	Central California	11.37	6.80	4.57
Royal	Central California	13.14	5.80	7.34
Peach	Central California	13.48	6.71	6.77
Moorpark	Central California	11.90	7.90	4.00
Royal	Fresno	10.23	6.76	3.47
Moorpark	Fresno	11.62	6.66	4.96
Hemskirke	Fresno	10.09	6.43	3.66
Royal	Pomona	13.00	7.80	5.20
Royal	Contra Costa	10.68	6.30	4.78
Royal	San Luis Obispo	11.50	6.80	4.70
Average, 11 samples.		11.69	6.78	4.91

From the foregoing record it appears that the "Cutting's" sample contains, as it stands now, 3.37 per cent of cane sugar over and above what is shown as the average in the flesh of fresh apricots; or each 100 pounds of the sample contains 3.37 pounds of cane sugar, equivalent to 67.4 pounds per ton of 2,000 pounds, from which a drawback should be obtained. The amount above rates at 1.15 ounces of cane sugar per can of two pounds.

It appears that the "water sample" was made up with nearly an equal bulk of water, for it contains 6.32 per cent of total sugar as against 11.69 per cent for the average for the apricot flesh cooked in its own juice. If the "Cutting's" lot was manufactured in the same way, viz: diluted from the original to twice its volume, and an allowance be made for the same, then its content of cane sugar (8.28) becomes nearly doubled, and instead of 67.4 pounds there would be nearly 135 pounds of cane sugar per ton, upon which a drawback might properly be allowed. This would mean that nearly all of the cane sugar (8.28 per cent) reported above would fall into the drawback class, and the Government in allowing this would suffer no loss, because the sample actually shows, in addition, 7.92 per cent of invert-sugar (grape and fruit sugar). This happens from the change of the originally added cane sugar into invert-sugar, by action of acids of the fruit upon it. Thus a great change in the *quality* of the sugar occurs, while the *quantity* remains approximately the same.

The Government, then, will always come out ahead of the canners in the contention in question; and upon trustworthy records it is hard to imagine a case of the kind involved where any loss will fall upon the Government.

SUMMARY BY PROFESSOR HILGARD.

The result of the work on canned apricots, with reference to the content of sugar and the possibility of determining in the canned samples the amount of sugar for which the Government should grant a drawback when exported, may be thus summarized:

The amount of cane sugar found in any canned sample of apricots will always be less than that which the canner has added, plus the amount originally contained in the fruit, for the reason that in the process of canning the acid of the fruit will transform a part of the cane sugar into invert-sugar, which is practically identical with that naturally occurring in the fruit alongside of cane sugar.

The extent of this transformation increases with time elapsing after the canning; this is apparent from the result obtained in the "water sample," in which no sugar was used. On the supposition, apparently justified by our average for California fruit as given in the table, viz: that an amount of water nearly equal to the bulk of the apricot was added, nearly two thirds of the cane sugar originally contained in the fruit was "inverted" into "fruit sugar."

The Government might, perhaps, adopt our average of eleven analyses for the two sugars and their totals, and allow rebate upon the difference as the amount of sugar artificially added.

Note: It is but fair to add that the Government allowed the claim of the canners for the season in question.

INVESTIGATIONS OF CANNED PRODUCTS.

By E. W. Hilgard and G. E. Colby.

During the past two years the Station has had several communications from canners of vegetables, milk, etc., in relation to difficulties encountered by them in respect to the keeping qualities of their products. These inquiries have led to investigations both of the materials used in the manufacture of cans, and of the processes employed in filling them; and some of the results gained are of sufficient interest for publication.

One of the applications was from an establishment making a specialty of asparagus canning, and in this case there seemed to be two different modes of spoiling; one, a "souring" unaccompanied by any considerable evolution of gas; the other (called "swells"), souring accompanied by fermentation, which made the cans bulge, so that on pricking them gas hissed out of the vent.

Spoiled cans of the first kind were examined, and their liquor found to be not only acid, but also acrid to the taste; the acidity was quite three times as high as that of the "good" cans, and the tin was found to be blackened in streaks inside. It was also noticeable that the solder in these was corroded. The proper tests showed that the liquor in these contained notable quantities of tin and zinc; also a small amount of lead. The latter was evidently derived from the solder used, which was too rich in lead; the tin was derived both from the solder and the can itself, which was much corroded on the surface; while the zinc could only be attributed to the fluid used in soldering.

An examination of empty cans, just as manufactured, showed that the chlorid-of-zinc soldering-fluid, used in machine soldering, was quite abundantly present in all the seams, but especially in the wide lap

used, of which only a small part—say one third—was filled with solder, leaving abundant space for all the surplus soldering-fluid to remain in the empty space of the lap. The average amount of soluble zinc chlorid thus retained was found to be about three quarters of a grain of this powerful antiseptic; being nearly the maximum medicinal dose sometimes prescribed for patients suffering from cancer. Upon inquiry it was learned that it was not the habit to wash these cans before use for canning; and thus the acrid taste of the can-liquor was sufficiently explained.*

It was suggested to the canners that either the use of the zinc chlorid soldering-fluid should be abandoned, or that at least the cans should be thoroughly rinsed before use; and that the lap at the solder joint should in any case be made as narrow as possible, so as to diminish to the utmost practicable extent the capillary retention of the metallic solution.

Cans subsequently manufactured by the firm, with narrow instead of wide laps, showed at once a diminution of the chlorid of zinc in the empty can, to nearly one half, *before* washing; while after rinsing with hot water, the amount of the compound was reduced to one eighteenth; being, all told, a reduction of the original average to one thirty-third part; an almost negligible quantity. It was nevertheless suggested to the firm that the use of rosin should be substituted for that of the zinc salt; since the vegetable juices would be sure to dissolve also those portions of the zinc compound that by their action in cleaning the metallic surfaces, would be rendered insoluble in water.

The examination of the contents of "spoiled" cans fully corroborated the importance of this advice. The can liquors were poured off and analyzed; and as the solid portions of the can contents were found to contain 92 per cent of water, a corresponding amount was added to the results obtained from the can-liquor directly examined. The average total amount of zinc chlorid in the contents of the one-pound cans examined in 1897 was thus found to be 6.30 grains; in the half-size cans of 1898, it was 3.38 grains. As one of the latter would be only a fair lunch for one person, the victim would thus consume more than a triple maximum dose of this metallic poison. Fortunately, the acrid taste would warn him before it was too late.

The table below gives the numerical details of this investigation:

EXPERIMENTS SHOWING THE INFLUENCE OF HEATING UPON THE LIQUOR OF CANNED ASPARAGUS, CONTAINING VARIOUS AMOUNTS OF SOLDERING-FLUID.

	Number of Cubic Centimeters of Normal Potash per 100 of Liquor.		
	With One Teaspoon of Soldering-Fluid per Can.	"Swells."	"Good."
"Original acidity"	2.60	1.80	.80
After heating 5 days	2.60	2.40	1.35
After heating 10 days	3.20	3.80	1.40
After heating 15 days	4.00	4.00	1.45
Zinc chlorid, grains per can	29.31	25.79	1.40

*The manufacturers of the soldering compound used state it to be "free from acid." This in a literal sense is correct; but chemically, zinc chlorid acts in soldering as an acid, to dissolve the oxids on the surface of the metal; and upon this its action depends.

The analysis having shown that the salt used contained considerable magnesium chlorid, which, on account of its ready decomposability, acts similarly to zinc chlorid or free chlorhydric acid in dissolving metals and their oxids, the effects of further heating upon the can contents was tested. In this experiment there was used one "good" can; one to which before sealing the firm had, at our suggestion, added a teaspoonful of soldering-fluid; and one "swell." The results are given in the table below. It will be seen that in all cases the acidity of the can contents increased materially, it being nearly doubled.

This is doubtless to be accounted for by the transformation of the characteristic crystallizable ingredient of asparagus, asparagin, into aspartic acid, by the action of the zinc chlorid. But what is more important, it is seen that the "swell" contained only a little less of the objectionable metallic salt than that to which a teaspoonful had purposely been added; evidently a case where the solderer had been specially liberal in his use of the fluid, and showing what a careless workman may at any time inflict upon the innocent consumer, when after the use of zinc chlorid soldering-fluid, the cans are not carefully rinsed before use for canning.

In all these analyses a not inconsiderable amount of tin was found to accompany the zinc, evidently dissolved by the acid zinc salt or by the magnesic chlorid in the common salt employed. The firm was therefore advised to use, instead of the impure commercial salt, the pure rock salt now readily obtainable.

SUMMARY OF EXAMINATION OF CANS AND CANNED ASPARAGUS FOR SALTS OF TIN, ZINC, AND LEAD.

New Cans.

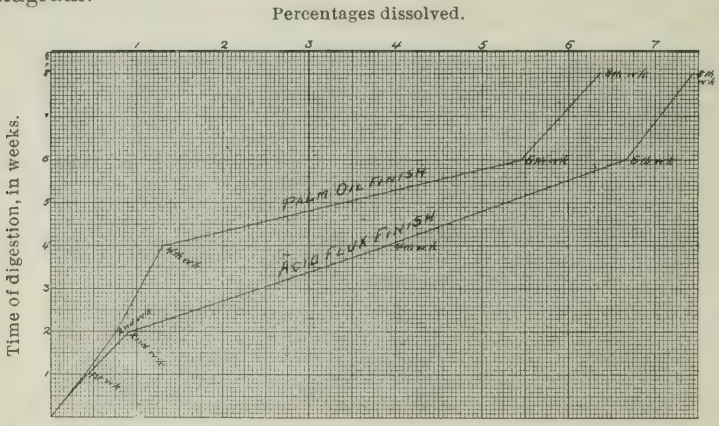
	Grains per Can.		
	Tin Chlorid.	Zinc Chlorid.	Lead Salts.
SMALL CANS; 1898. Wide lap.			
No. 1	--	.95	traces
No. 2	.01	.81	traces
No. 3	.02	.70	traces
LARGE CANS; 1898. Narrow lap.			
No. 1; not washed	--	.58	traces
No. 2; washed	--	.03	------

Canned Asparagus.

	Tin Chlorid.	Zinc Chlorid.	Lead Salts.
LARGE CANS; 1897.			
Liquid of not-affected cans	.70	1.50	traces
Liquid of affected cans	1.05	4.50	traces
Average total contents of an affected can contained	1.837	6.30	traces
SMALL CANS; 1898.			
Total Liquid per can contains:			
No. 1	.342	1.23	traces
No. 2	.500	1.35	traces
Average total contents of a can contain	1.095	3.38	traces

Quality of the Tinned Sheet.—In all these investigations it was noted that the tin covering of the iron sheet was very imperfect, and that it seemed, in the spoiled cans, to be perforated by innumerable little holes through which the iron base-metal could be seen by means of a lens. Upon inquiry it was found that the firm used the tin sheet manufactured by the "acid flux" process, instead of the "palm-oil finished." The former is amply good enough for coal-oil cans and the like, but, as is well known, soon rusts when the coal-oil is removed.

It was then decided to try the comparative effect of dilute acid upon tin sheet of the two kinds. Slips of 72 square inches were each separately immersed in chlorhydric acid of 2 per cent strength, which was renewed, equally for both, every seven days. The table below shows the results obtained in this manner, which are also shown graphically in the diagram.



Graphical Illustrations of the Above Results.

It will be seen that during the first week there was practically no difference in the amount of iron dissolved; it was derived only from the cut edges, where the acid had free access. But during the second week there began a divergence of the attack of the acid, which culminated at the end of the fourth week; when the acid-flux plate was full of perforations and showed a rapid scaling off of the tin covering, while three times the amount of iron, as compared with the "palm-oil-finished" plate, had passed into solution.

Since the dissolution of tin will progress in a geometrical ratio so soon as the perforation of the tin film permits of galvanic action being established between the two metals at numerous points, it is quite clear why so much corrosion of the surface was shown in the asparagus cans made of "acid-flux" finished sheet. The inference is plain that in putting up acid fruits and vegetables such sheet should not be used at all.*

This result is entirely in line with the experience of tinners, that a soldering bit coated by means of zinc chlorid will lose its tinning very quickly, while when coated by the aid of rosin or fat, the coating burns off much more slowly.

* It is claimed by the manufacturers of the "acid-flux" sheet that, inasmuch as their sheets are also finally subjected to a bath of tin covered with oil, their sheet is "oil-finished" as truly as the other. But this final bath cannot make up for the less perfect adhesion between the two metals, as against that resulting from the "old process" treatment.

TEST OF RESISTANCE OF TIN PLATES

To Cold Hydrochloric Acid (Strength 2 Per Cent) by Determining the Amount of Iron Dissolved at Regular Intervals of Time of Digestion.

	Tin Plate. Palm Oil Finish.		Tin Plate. Acid Flux Finish.		Remarks.	
Am't treated, in grams	54		51			
Surface exposed, sq. in.	72		72			
Time of Digestion. (Acid Renewed at End of Each Period.)	Per Cent of Iron Dissolved.	Color of Liquid.	Per Cent of Iron Dissolved.	Color of Liquid.	Plate, Palm-Oil Finish. Appearance, Etc.	Plate, Acid-Flux Finish. Appearance, Etc.
End of 1st week	.41	No color	.42	No color	Surface bright	Perceptible change in brightness.
End of 2d week	.82	No color	.92	Yellowish	Surface bright	Quite tarnished.
End of 4th week	1.31	No color	3.90	Very yellow	Edges only tarnished	Tarnished, many perforations; beginning to scale.
End of 6th week	5.46	Yellow	6.63	Very yellow, turbid	Still bright, some perforations	Badly eaten, coated with iron rust.
End of 8th week	6.34	Very yellow	7.45	Very yellow, very turbid	Pretty well eaten, surfaces where not perforated much tarnished	Finish completely destroyed.

Defective Sterilization.—Another point was prominently called to the attention of the Station in connection with the difficulties experienced by canners with certain conserves, of which a considerable proportion oftentimes spoils by fermentation before it reaches the consumer. Among these, tomatoes are perhaps the most frequently partially or wholly "soured"; and the same is true of most conserves that become mushy or, when remaining whole, pack very closely so as to impede the circulation of the can-liquor. In such cases (as e. g., asparagus, gooseberries, etc.) the usual prescription of heating the cans for twenty minutes in boiling water or slightly overheated steam, is not sufficient to heat the mass through to the center so as to destroy all ferments; so that bacteria requiring no air for their action or development (anærobic) will remain alive, and in due course of time become active. This was found to be the case in a lot of "canned cream," a large consignment of which was returned to the factory in consequence of a considerable proportion having "swelled" and on opening possessing a very disagreeable "old cheese" flavor. It was found on inquiry that all proper precautions had been used by the factory, including the use of "palm-oil finished" sheet, and that of rosin instead of acid-flux in soldering. But the cans had been heated, after sealing, only for a short time and in one position, instead of being inverted at least once in order to commingle the hot and cold portions of the thick fluid within.

The common practice of housewives, to invert each jar as soon as sealed, is effective not only in sterilizing the air-bubble by its passage through the hot can-liquor or pasty mass, but also in so agitating the latter as to insure a proper heating of the central as well as outside portions of the contents. In the case of gooseberries and asparagus, which pack very closely, this alone is not effectual; it is necessary to continue the heating of the cans or jars for a sufficient length of time to insure the penetration of the sterilizing temperature to the very center; and for this, in the case of asparagus especially, twenty minutes heating is not sufficient, the packed mass heating very slowly sideways. To rely alone on the heat carried into the can from the "processing pan," is certainly very unsafe, in view of the varying skill and dexterity of workmen in filling the cans quickly enough for this purpose. Certainly, where such products are to be shipped to or through the tropics, a subsequent heating of the packages to a temperature, and for a length of time, sufficient to insure complete sterilization, should be considered essential. But it is impossible to give generally valid prescriptions in this regard; each establishment must adapt its practice to the nature of its products, so as to avoid unnecessary overheating, injuring the flavor of the conserves, while yet insuring complete conservation.

SOME PHYSICAL AND CHEMICAL PROPERTIES OF SALAD OILS.

By George E. Colby.

The following compilation of existing data relative to the composition of American and European salad oils was made in October, 1898, at the request of the Committee on Food Standards of the Association of Official Agricultural Chemists.

The chief object of the committee is still to gather and give "authoritative American data which might serve to the food analyst and producer the same purposes which that portion of the United States Pharmacopœia relating to the composition and purity of drugs, serves to the pharmacist." With this basis of unified data it is possible to formulate standards.

Because of the great differences in the products of the orchards of this country (California especially) and of Europe, this Station has been engaged for several years in systematic investigations of California fruits, oils, wines, etc. As this work advanced, the necessity for it became greatly emphasized; and as an instance of this we will cite that of the iodin test alone. European chemists have placed great reliance upon the *iodin number* of olive oil as a test of purity, accepting the figure 86 as the proper standard for it. As early as 1890, this Station pointed out that this figure was probably *too low*, and later analytical work here and elsewhere in California has verified this. Eastern chemists have often found a figure higher than 86 for the iodin number of California olive oils, and before venturing an opinion as to the purity of them have made inquiry of this Station. Thus this heretofore valuable test has become for our oils rather uncertain; the more so as the higher this number is the nearer it approaches that held by cottonseed oil.

It is to bring such facts as these more generally before food chemists and producers that this Station undertakes this class of work, and thereby protects our products from unjust condemnation when judged according to European standards.

The physical and chemical properties of salad oils reported upon are as follows: Index of refraction; specific gravity; thermal degree; viscosity of soap solutions formed from oils; iodin number; saponification value; melting point of fat acid from oils; special tests, viz: Brullé's, Bechi's, etc.

The results in the tables below are arranged in two general classes: those under "A" relate to pure olive oils; those marked "B" relate to seed oils and other oils, all of which are liable to be used to adulterate olive oil.

The pure olive oils reported upon fall into several subdivisions, viz: (I.) Commercial samples of olive oil delivered in person by makers, and analyzed at their request by the California Agricultural Experiment Station. These oils gave no reaction for cottonseed oil and other seed oils. (II.) Samples of olive oil made by the Agricultural Experiment Station, University of California. (III.) Samples of pure olive oil made in the Department of Chemistry, University of California, by Mr. W. C. Blasdale. The essential difference between the samples marked "first" and "second" is that the latter include oil from the pits as well as from

the pulp of the olives. Analyses reported in Jour. of Amer. Chem. Soc., Vol. XVII, No. 12, Dec., 1895. (IV.) Commercial samples of pure olive oil received by the chemist of the Health Department of San Francisco, California, from the makers. Analyses given in the Report of the Health Department of San Francisco, Vol. 3, No. 1, July, 1897. (V.) Oils submitted to Professor Rising, State Analyst, Berkeley, California, for examination. Analyses given in "Methods of Detecting Adulterations in Olive Oil"; Report of Olive-Growers' Convention, held in San Francisco in 1891. (VI.) European and other olive oils.

Special tests for seed and other oils are as follows: Brullé's for seed oils; Bechi's for cottonseed oil; Schneider's for rape and colza oils; Renaud's for Arachis or peanut oil; Badonin's for sesame oil; and Hauchecorne's for mixed oils.

General tables giving detailed data on each of the points enumerated above have been prepared, and from which the conclusions and summary have been drawn; but because of lack of space in this report only two of them are given, viz: that giving the "thermal degree" of a large number of oils, and that showing the viscosity of soap solutions formed from them.

1. THERMAL DEGREE.

A. Pure Olive Oils.

California Olive Oils.								European and Other Olive Oils.	
I.		III.		IV.		V.		VI.	
Commercial samples delivered in person by makers and analyzed at their request at Agr. Expt. Station.		Samples made at Dept. of Chem., U. of C., Berkeley, by W. C. Blasdale.		Commercial samples of pure olive oil received by Health Dept. of S. F. Cal., from the makers.		Oils submitted to State Analyst, Berkeley, Cal.			
Mark.	Thermal Degree.	Mark.	Thermal Degree.	Mark.	Thermal Degree.	Mark.	Thermal Degree.	Thermal Degree.	Observer or Authority.
159	40.25	1	47.0	230	42.7	1	35.0	39—45 (5 observers.)	Allen; Com'cl Organic Analysis, vol. 2, page 56.
163	41.00	2	47.0	231	43.3	2	39.5		
165	39.80	5	46.0	232	43.8	3	37.5		
		6	45.0	233	42.7	4	41.0		
		8	46.0	234	40.8	5	38.6		
		9	47.0	235	41.6	8	36.0	32—34.5	Cannizzaro & Fabris.
		10	46.0	236	44.2	9	34.5		
		11	46.0	237	43.3	10	34.0	43.8 — 44.8 (99% H_2SO_4)	Thomson & Ballantyne; Alder Wright, p. 150, or J. S. C. Ind., 1891, page 213.
				238	42.2	11	35.0		
						12	34.0		
Max.	41.00		47.0		44.2		41.0	45	
Min.	39.80		45.0		40.8		34.0	32	

B. SEED AND OTHER OILS.

Oils.	Thermal Degree.	Observer or Authority.
Cottonseed Oil, crude	68—69	Allen; Commercial Organic Analysis, vol. 2, page 56.
Cottonseed Oil, refined	74—75	Allen; Commercial Organic Analysis, vol. 2, page 56.
Cottonseed Oil	79	Report of California State Analyst, page 10.
Rapeseed Oil	58	Thomson & Ballantyne, Jour. Soc. Chem. Ind. p. 233, and Alder Wright, Oils, Fats, and Waxes, page 150.
Rapeseed, Colza Oils	51—60	Allen; Commercial Organic Analysis, vol. 2, page 56.
Mustardseed Oil	49.5 to 58.5	Report of California State Analyst, page 10.
Mustardseed Oil	51.0	Report of Chemist of Health Dept., S. F., vol. 3, No. 1, page 2.
Arachis (Peanut) Oil	47 to 67	Allen; Commercial Organic Analysis, vol. 2, page 56.
Arachis (Peanut) Oil	55.5	Report of Chemist of Health Dept., S. F., vol. 3, No. 1, page 2.
Sesame Oil	65—68	Allen; Commercial Organic Analysis, vol. 2, page 56.
Sesame Oil	62.2	Report of Chemist of Health Dept., S. F., vol. 3, No. 1, page 2.
Poppyseed Oil	74—88	Allen; Commercial Organic Analysis, vol. 2, page 56.
Nut (Walnut) Oil	110	Blasdale; Jour. Amer. Chem. Soc., vol. XVII, No. 12, Dec. 1895.
Nut (Walnut) Oil	101	Allen; Commercial Organic Analysis, vol. 2, page 56.
Lard Oil	54.2	Foods & Food Adulterations, U. S. Dept. of Agr., Div. of Chem., Bulletin 13, part 4, page 500.
Lard Oil	41	Allen; Commercial Organic Analysis, vol. 2, page 56.
Lard Oil	38.3	Report of Chemist of Health Dept. of S. F., Cal.
Fish (Menhaden) Oil	126	Allen; Commercial Organic Analysis, vol. 2, page 56.

The determination of the amount of heat developed with sulfuric acid was made as described in Wiley's Agricultural Analysis, vol. 3, page 357.

2. VISCOSITY OF SOAP SOLUTIONS FORMED FROM OILS.

Viscosity calculated in terms of the number of grams of sugar necessary to add to a litre of water to produce a solution of equal viscosity. Determined by the Babcock Method (N. Y. Agrl. Expt. Station, Geneva—Report 1887, page 383).

Analyst, W. C. BLASDALE.

(Jour. Amer. Chem. Soc., Vol. XVII, No. 12.)

PURE OLIVE OIL.		COMMERCIAL OILS.		MISCELLANEOUS OILS.	
Mark.	Viscosity.	Mark.	Viscosity.	Oils.	Viscosity.
1. Pendulina (1)	648	18	305	Cottonseed	280
2. Pendulina (2)	593	19	615	Rapeseed	670
3. Uvaria (1)	573	20	320	Poppyseed	95
4. Uvaria (2)	598	21	461	Sesame	415
5. Rubra (1)	655	22	653	Peanut	220
6. Rubra (2)	650	23	275	Lard	250
7. Redding Picholine	587	25	585	Sweet almond	645
8. Nevadillo Blanco (1)	595	26	568	Walnut	100
9. Nevadillo Blanco (2)	610	27	653		
10. Manzanillo (1)	625				
11. Manzanillo (2)	623				

SUMMARY.

The *Index of Refraction* for pure olive oil of California production at 15.5° C., ranges from 1.4689 to 1.4717. This index for cottonseed oil ranges from 1.4732 to 1.4752 (15 to 15.5° C.); mustardseed oil, 1.4705 to 1.4742 (15.5° C.); sesame oil, 1.4734 to 1.4762.

The *Specific Gravity* of pure olive oil of California production at 15.5° C. rates from .914022 to .9185. Cottonseed oil ranges in gravity from .9218 to .9300; mustardseed oil from .914880 to .9161; seasame oil from .9210 to .9240.

The *Thermal Degree*, or heat set free with sulfuric acid, for pure California olive oil ranges from 34.0° C. to 47° C. Cottonseed oil yields a rise of temperature of 68° C. to 79° C.; mustardseed oil from 49.5° C. to 58.5° C.; peanut oil, 47° to 55.5° C.

The *Viscosity of Soap Solutions* formed from pure California olive oil of known make, ranges from 573 to 655; one of the commercial samples of olive oil fell as low as 275, another as low as 305. Cottonseed oil, 280; lard oil, 250; poppyseed oil, 95.

The *Iodin Number* for pure California olive oil of absolutely known make ranges from 77.7 to 93.5; some of the commercial samples believed to be pure olive oil show high iodin numbers, viz, 92.4 and 93.3. The iodin number for cottonseed oil ranges from 100 to 116.97; for peanut oil, 87.3 to 103; lard oil, 66.36 to 79.4.

The *Saponification Value* for pure California olive oil is from 187.0 to 193.52; cottonseed oil, 191.0 to 210.5; peanut oil, 190.1 to 197.0; lard oil, 191.0 to 196.0.

The *Melting Point of Fatty Acids* from pure olive oil of California production shows a variation of from 21° C. to 26° C.; cottonseed oil (fatty acid) from 34.6° C. to 42° C.; peanut oil (fatty acid), 27.7° C. to 35° C.; sesame oil (fatty acid), 26.0° C. to 35.0° C.

The *Pure Olive Oils* examined here have not responded to the special (color) tests used to distinguish various seed oils; for example, Badonin's test for sesame oil made upon pure California olive oil produces no crimson color.

Mixed Oils are often so compounded that their specific gravity, iodin number, etc., are similar, or even identical, with those of pure olive oils; therefore, the special tests for seed and other oils should never be neglected.

Pure olive oil of California production, according to the data at hand, has an *index of refraction* at 15.5° C. of 1.4689 to 1.4717; a *specific gravity* at 15.5° C. of from .914022 to .9185; a *thermal degree* of from 34.0° C. to 47.0° C.; a *high viscosity* of soap solution formed from the oil; an *iodin number* varying from 77.7 to 93.5; a *saponification value* of about 190, and a *melting point of fatty acids from the oil* from 21° C. to 26° C.

CONCLUSIONS.

Summarizing the observations made at this Station upon salad oils, it appears that the determination of the *index of refraction* affords but little help in detecting adulterations in olive oils, the more so when the additions of seed and other oils are not large. The same may be said of the value of the test of *specific gravity* of the oil, and the melting point of the fatty acids. From the *saponification-coefficient* but little evidence, if any, except corroborative weight, can be obtained.

The *iodin number*, a determination so much relied upon by Continental chemists as an indication of purity of oils, appears to be of value here, although the limits of the test are greatly changed; the upper limit having increased, with us, several points above that usually accepted; i. e., from about 85 to 92 or 93, which renders it impossible to

detect by this means, as small admixtures of several seed oils as was formerly supposed could be done.

The *viscosity* of soap solutions formed from oils promises to be a valuable means of detecting adulterations, especially lard oil, for which there is no very satisfactory specific test. This can be seen by noting the wide difference, nearly 3 to 1, between the viscosity of the soap solutions of olive oil and lard oil.

The *thermal-degree* test is very satisfactory, and has been carried out upon a sufficient number of oils to warrant placing considerable dependence upon it.

By a careful application of the special (color) tests for seed and other oils, in conjunction with the iodin number, thermal degree, and viscosity of soap solution, it seems that we have sufficient and satisfactory data upon which to base an opinion upon the purity of commercial salad oils.

Under present conditions, as stated above, no *single* tests should be relied upon alone, but all corroborative evidence should be obtained before forming a conclusion which may involve large monetary interests.

REPORT ON SALAD OILS.

(Final Report on Salad Oils to the Committee on Food Standard of the Association of Official Agricultural Chemists, March, 1900.)

DEFINITIONS.

Olive Oil.—The expressed and clarified oil from the fruit of *Olea Europæa*, L. Standard olive oil should have chemical and physical values between the following limits:

Index of refraction at 15.5° C.	1.4689 to 1.4717
Specific gravity at 15.5° C.	.9140 to .9185
Thermal degrees (rise of heat with sulfuric acid)	32.0° C to 47.0° C
Iodin number	75.2 to 93.5
Saponification value	183.2 to 196.0
Melting point of the fatty acids from the oil	21.0° C to 28.0° C

Oils falling outside of the above limits should afford special proofs and tests of genuineness.

The following oils are used as salad oils or as adulterants of olive oil:

Name of Oil.	Source.
Cottonseed oil	*Gossipium herbaceum*, L.
Sesame, teel, or benne oil	*Sesamum Indicum*, L.
Arachis, peanut, earth-nut, or ground-nut oil	*Arachis hypogæa*, L.
Rapeseed oil	*Brassica campestris*, L.
Colza oil	*Brassica campestris* var. *oleifera*.
Black mustardseed oil	*Sinapis nigra*, L.
White mustardseed oil	*Sinapis alba*, L.
Poppyseed oil	*Papaver somniferum*, L.
Linseed oil	*Linum usitatissimum*, L.; *L. perenne*, L.
Walnut oil	*Juglans regia*, L.
Beech-nut oil	*Fagus sylvatica*, L.
Hazel-nut oil	*Corylus avellana*, L.
Sunflower oil	*Helianthus annuus*, L.
Almond oil	*Amygdalus communis*, L.
Maize or corn oil	*Zea mays*, L.
Lard oil	Lard.

TESTS OF VARIOUS ANTISEPTICS.

By Frederic T. Bioletti.

Purifine.—In May, 1897, a commercial sample of a solution called Purifine was received by the Agricultural Experiment Station for examination. The claims made for this fluid on the label are, among others, that, used in the proportion of one part to twenty or fifty of water, "*it will be more effective than any disinfectant known*"; that it is a "*sure preventive of cholera, smallpox, etc., and all contagious diseases,*" while as an antiseptic and healer the claims cover almost all imaginable cases. The composition of the solution is given on a label as follows:

Formula.

Purifine is composed of the following: Chloride Calcium, Chloride Magnesium, Chloride Sodium, Sulphate Alumina, with free Chlorine, Bromine, and Iron.

An analysis made by Assistant Chemist George E. Colby, at the Station, gave the following composition:

Analysis of Purifine.

Free Chlorin	none.
Free Bromin	none.
Mineral Matters—	Grains per Gallon.
Potassium Chlorid	269.2
Sodium Chlorid (Common Salt)	6,778.0
Calcium Chlorid	6,490.1
Magnesium Chlorid (Bittern)	3,385.6
Aluminum Chlorid	1,844.3
Ferric (Iron) Chlorid	454.2
Calcium Sulfate (Gypsum)	19.6
Magnesium Bromid	120.2
Total	19,361.2

The absence of free chlorin and bromin (readily observable by any one noting the absence of odor) disproved all claims of a high disinfectant value for the fluid, as all of the ingredients found have very weak germicidal or disinfectant power.

However, since a harmless and inodorous antiseptic which will inhibit the growth and multiplication of putrefactive and disease germs is of great importance for many sanitary purposes, even though it may have little effect in actually *killing* the germs, a series of bacteriological experiments were made with "Purifine"; the object being to determine what is the relative antiseptic power of "Purifine" compared with that of other similar antiseptics. The method adopted was to add various quantities of the antiseptics to sterilized flasks of the ordinary beef bouillon, used in bacteriological laboratories, and then to inoculate with a mixed culture of putrefactive bacteria.

After determining the antiseptic strength of "Purifine," that of its principal constituents individually was tested. These are aluminum chlorid, magnesium chlorid, and calcium chlorid. These tests showed that the principal part of the antiseptic power of the "Purifine" came from the aluminum chlorid it contained. As the commercial Purifine proved to be but a weak antiseptic, an attempt was made to improve it by adding commercial aluminum sulfate in sufficient quantities to replace the calcium chlorid with the aluminum compound. The result-

ing liquid was found to have over six times the antiseptic strength of the original Purifine. Other tests were made with aluminum sulfate alone, and of the same mixed with common salt, to convert it into aluminum chlorid. Further tests were made with "bittern water," a waste product of salt works. The bittern water itself has very little antiseptic value; but when mixed with aluminum sulfate so as to replace the calcium and magnesium compounds (especially when previously concentrated) it forms a liquid greatly superior to the commercial Purifine.

The table on page 172 shows the relative strength of the various fluids tried and the cost of the amount necessary for preventing bacterial growth in 100 gallons of sewage.

This table refers only to the *antiseptic* powers of the various substances and not to their disinfectant or properly *germicide* effects. A disinfectant is a substance which actually *kills* the germs of putrefaction. This is not necessary nor practicable in the treatment of sewage, nor for many other sanitary purposes. An antiseptic, on the contrary, is a substance which, while not necessarily killing any germs, prevents their growth and multiplication. In the treatment of sewage, therefore, the proper use of an antiseptic may prevent the production of sewer gas by suppressing the growth of the bacteria, to which it is due. As the sewer gas is the chief if not the only source of danger from sewage, complete disinfection is not necessary, and in fact would be so costly as to be impracticable.

What is needed, then, for municipal and private use in sanitary precautions of this nature, is an antiseptic of moderate cost and free from such objectionable features as an unpleasant odor, or a soiling or corrosive effect on basins, pipes, etc.

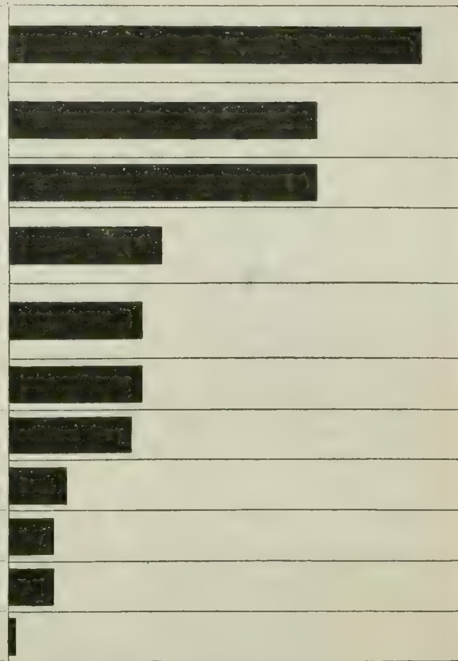
All the substances in the above table are free from these objectionable features, but differ very widely in cost and convenience. An examination of the first column of figures shows that the cost of treatment for 100 gallons of sewage varies from $0.19 for the first two compounds to $12 for Purifine, the same effective value costing in the latter over sixty-three times as much as in the former. Of course the difference would not be quite so great if the first two were sold on a commercial basis, but even then they could easily be sold for one thirtieth the price of the latter. Moreover, No. 4, consisting of commercial aluminum sulfate, and common salt, and costing one thirtieth as much as Purifine, can easily be mixed by any one.

With regard to convenience the difference is also very great. Where it would be necessary to use 12 gallons of Purifine, only 4 gallons of the solution No. 4, containing aluminum sulfate and common salt, would be needed, while with solution No. 1, 1½ gallons would be sufficient. This difference of bulk to handle is of great importance in the matter of labor and expense.

Sea Water.—The use of sea water has been suggested for flushing and purifying the sewers of San Francisco. As the antiseptic value of sea water is very small it would practically have no purifying effect. Tests were made to determine how much commercial aluminum sulfate must be added to sea water to make it effective in preventing decay and sewer gas in the drainage of the city. It was found that 55 lbs. added to every 100 gallons of sea water will make an antiseptic that is sufficiently effective in preventing decay when used in the ratio of 18 gallons

COMPARISON OF VARIOUS ANTISEPTICS.

Compostion of Antiseptic.	Cost.*	Gallons.**	Comparative Strength.
1. Bittern water concentrated half, + 4.4 lbs. per gal. commercial Aluminum sulfate + 5 oz. per gal. Boracic acid	$0.19	1.5	
2. Bittern water concentrated half, + 4.4 lbs. per gal. commercial Aluminum sulfate	.19	2.0	
3. Purifine + 2.45 lbs. per gal. Aluminum sulfate	2.10	2.0	
4. Commercial Aluminum sulfate 3.33 lbs. + Sodium chlorid 3.33 lbs. + water one gallon	.40	4.0	
5. Bittern water one gallon + commercial Aluminum sulfate 3.5 lbs.	.32	4.5	
6. Aluminum chlorid (C. P.) one lb. + water one gallon		4.5	
7. Aluminum sulfate (C. P.) one lb. + water one gallon		5.0	
8. Boracic acid 5 oz. + water one gallon	.31	10.0	
9. Purifine	12.00	12.0	
10. Magnesium chlorid (C. P.) one lb. + water one gallon		12.0	
11. Calcium chlorid (C. P.) one lb. + water one gallon		50.0	



*Cost of the amount given in the second column. **Number of gallons necessary to prevent decay in 100 gallons of decomposable matter—sewage, etc.

to each 100 gallons of average sewage. This would cost about 20 cents for every 100 gallons of sewage treated, and would therefore be too expensive for general use, but would be very useful for hospital and for domestic use in water-closets.

It cannot be too strongly urged that aluminum sulfate, the effective base of the above preparations, should be imported or manufactured here on the large scale for antiseptic purposes. The commercial article can even now be delivered in San Francisco at 3 cents per pound, wholesale.

California Laurel.—A sample of extract of California laurel (*Umbellularia Californica*, Nutt.), together with a sample of water containing oil extracted from the same trees, was received from Hermann Cordes, Alameda, with the request that their value as antiseptics should be tested. Tests showed that neither liquid had any appreciable restraining influence on the growth of bacteria.

OLIVES.

Bulletin 123 of the Station, by F. T. Bioletti and G. E. Colby, treats of the cultivation of olives, pickling, oil-making, and diseases. Although very generally distributed there are still a large number of copies on hand, which may be had on application. The contents embrace climatic and soil conditions for best results; propagation; transplanting and care; pruning; budding and grafting; gathering the fruit; oil-making, with description of presses, etc. Then the several processes of pickling are described, with precautions regarding grading and sorting; a comparison in nutritive value between the California ripe and the Spanish green-pickled olives. The various diseases to which the olive tree is subject are treated of. The second division of the bulletin describes a number of the chief varieties of olives and their adaptations, closing with a table showing variation in size of fruit, and amount of pit and oil.

6. PLANT DISEASES AND ENTOMOLOGY.

EFFECT OF DIFFERENT DEGREES OF LIGHT ON THE MULTIPLICATION OF WATER-BACTERIA.

By Frederic T. Bioletti.

In order to throw some light on the question of whether the water of a storage reservoir, filled from a small stream during the rainy season, could be best conserved from bacterial contamination by exposure to the direct sunlight, or by being roofed over to exclude the direct sun rays, or by being completely covered so as to leave the water in darkness, the following experiments were undertaken. It should be understood that the water was heavily contaminated with the drainage of cow pastures.

Water was taken from the inlet of the reservoir, and the number of bacteria determined by means of gelatine plates. The alkaline gelatine recommended by Frankland as most suitable to the growth of water-bacteria was used.

The water was divided into six equal portions and placed in glass dishes ten inches in diameter and four inches in depth. Each portion was treated differently, as follows:

A. Was placed near a south window, where it was exposed daily to direct sunlight for several hours.

B. Placed near window where it was reached by diffused light only.

C. Placed in a dark cupboard.

D. Placed in diffused light and treated first with a 10 per cent water-solution of commercial aluminum sulfate, and then with lime water in such proportion that each liter received .05 grams of the sulfate and .15 grams of lime. The precipitate which formed settled in a few minutes.

E. Placed in diffused light and treated with a water-solution containing 10 per cent of commercial aluminum sulfate and 10 per cent of common salt in such proportion that each liter of water received .05 grams of the sulfate and .05 grams of salt.

F. Placed in diffused light and covered with a thin layer of crude petroleum.

The bacterial content was determined at intervals, with the results shown in the following table:

NUMBER OF BACTERIA IN ONE CUBIC CENTIMETER.

	Untreated.			Treated.		
	A Sunlight.	B Diffused Light.	C Darkness.	D Al. Sulfate + Lime.	E Al. Sulfate + Salt.	F Crude Petroleum.
Initial number	12,330	12,330	12,330	12,330	12,330	12,330
1 hour	....	....	....	818	....	....
24 hours	....	2,640,000	....	1,040,000	1,210,000	529,000
48 hours	1,309,000	6,400,000	2,960,000	5,350,000	2,600,000	....
4 days	1,700,000	6,830,000	3,930,000	2,070,000	4,030,000	63,400

The above table shows a continuous rise in bacterial contents for four days, except in the case of D and F. The greatest increase is shown in B, untreated and kept in diffused light; the least in A, untreated and kept exposed to direct sunlight. The apparent decrease in F, the sample covered with a layer of crude petroleum, is susceptible of the following explanation: The samples for determination of the bacterial contents from each experiment were taken by plunging a sterilized pipette into the water to the middle layer. As by twenty-four hours a bacterial zoogloea scum had formed on the surface of all of the dishes, some of this scum was taken down by the pipette and drawn in with the sample for analysis. This of course caused grave errors in the figures obtained and did not give a correct idea of the actual bacterial contents of the water itself irrespective of the bacterial scum on the surface. At four days, however, this bacterial scum in F had, on contact with the petroleum, drawn itself together into strings and islands, leaving the intermediate space almost or quite free from scum. The determination made on the fourth day of F, therefore, is the only one which shows the true bacterial contents of the water after a bacterial scum had been formed.

To avoid this source of error, a different method of taking the successive samples for analysis was adopted in a second series of experiments. Another sample of water from the inlet to the reservoir was taken as before. It showed 26,210 bacteria per cubic centimeter. The water was then distributed equally in four sterilized 4-liter beakers, each of which was filled three-quarters full. At the same time six siphons were placed in each beaker for the purpose of obtaining subsequent samples. These siphons were made of glass tubing, about 2 mm. in outside diameter. The ends were drawn out to capillary tubes, one end sealed over a Bunsen burner; and the other end sealed in the same way, after strongly heating the whole siphon. This left a partial vacuum in each siphon. The inner end of the siphon reached to the middle of the water, the outer reached to a little below the bottom of the beaker. The capillary ends were made of slightly different diameter, the inner being slightly smaller than the outer, in order to insure the egress of the water in drops. When the sample was to be taken, the point of the inner end was broken off by pressing it against the side of the beaker, the water then rising to fill the partial vacuum. When the outer end was broken off with sterilized pincers, the water came out in small drops. The volume of these drops was first determined by catching them in a test tube, graduated to 5 c.c. Sterilized gelatine was then poured into Petri cap-

sules and inoculated with various numbers of drops, and the amount which each one received calculated. This method not only gives greater accuracy of measurement, but effectively prevents the admixture of bacteria from the scum. The following experiments were made with this method of taking samples:

A. Water untreated and exposed to sunlight for several hours daily.

B. Water untreated and kept in darkness.

C. Water treated with aluminum sulfate and lime, as in D of the foregoing table, covered with a thin layer of crude petroleum and exposed to sunlight for several hours daily.

D. Treated in the same manner as C, but kept in darkness.

The following table shows the results:

NUMBER OF BACTERIA IN ONE CUBIC CENTIMETER.

	Untreated.		Treated With Al. Sulfate + Lime + Petroleum.	
	A Sunlight.	B Darkness.	C Sunlight.	D Darkness.
Initial number	26,210	26,210	26,210	26,210
4 hours			1,005	1,005
24 hours	16,370	54,170	44	132
48 hours	532,500	851,300	87	237
4 days	35,630	140,600	35,630	52,860
8 days	88,800	127,000		251,000
10 days	264,600	303,000	358,000	250,000
26 days	51,500	8,000	313,200	193,000
26 days sample taken with pipette	10,350,000	Plate completely liquefied	1,070,000	460,000

These results do not accord with those in the former table, and the reason is apparent on comparing the two counts made on the twenty-sixth day of the last experiment. The first was made by the siphon method and represents the number of bacteria actually in the water; the second, made by taking the sample with an ordinary graduated pipette, represents the actual number present in the water plus those taken down from the surface by the pipette. The enormous discrepancy between the two counts shows the unreliability of the latter method.

In considering this table further it will be seen that the difference between the bacterial contents of the water exposed to sunlight and that of the water kept in darkness is much less than is shown in the former table. This is due, doubtless, to the greater germicidal action of the direct sunlight on the bacteria in the surface scum than on those in the body of the water. In the treated water, in fact, the highest number is shown by the insolated sample.

In considering columns A and B of the second table, it will be seen that there are two maxima, one at two days and the other at ten days. This probably means that at forty-eight hours there had been sufficient bacterial growth to exhaust the oxygen in the water and to produce a bacterial film on the surface which acted as an oxygen-screen. As the method of culture used in making counts permitted free access of air, none of the strictly anærobic bacteria were included. The figures, therefore, show only the number of bacteria present which are able to

grow in the presence of at least small amounts of oxygen. The second maximum doubtless shows that at about nine or ten days enough of the bacteria in the scum had become decrepit and lost their power of absorbing oxygen to allow the penetration of oxygen into the water and a consequent multiplication of the ærobic organisms. The second fall shown by the counts made on the twenty-sixth day is due to the exhaustion of nutritive substances in the water, which is the cause of the "auto-purification of water" which occurs in closed reservoirs, such as casks used for the water-supply of ships.

Columns C and D show that the decrease of bacteria due to precipitation by aluminum sulfate and lime continued for twenty-four hours, and that at forty-eight hours the increase was practically negligible. At four days, when the first maxima occurred in A and B, the bacterial increase had only brought up the number to from 1.5 to 2 times the initial number. The maximum was reached between the eighth and tenth days and there was but a slight decrease on the twenty-sixth day. Whether this maximum corresponds with the first or with the second maxima in columns A and B it is impossible to state positively from this experiment. It is possible that the film of petroleum interfered sufficiently with the formation of a bacterial scum to prevent it from exercising as fully as in the other cases its function of excluding the oxygen of the air. This seems probable from the much larger numbers found on counting-plates from samples taken with an ordinary pipette in columns A and B than in columns C and D. That some bacterial scum was formed, however, is equally apparent by comparing the relatively high numbers obtained in this way in columns C and D with those obtained through the siphons.

In conclusion: These experiments seem to show that there is little difference in bacterial contents whether the impure water is exposed to direct sunlight or kept in darkness, though what difference there is, is in favor of the sunlight. It is well known, of course, that the bacillus of typhoid fever is easily killed by direct sunlight, but it is doubtful if this effect would extend to the lower part of a deep reservoir.

There are, however, inconveniences attending exposure to sunlight which overbalance the slight gain in prevention of bacterial growth. This was well shown in experiments A of both series, where many colonies of diatoms formed on the surface and various forms of algæ grew at the bottom; while in those kept in darkness, and in those covered with a film of petroleum, none grew. The trouble that a large growth of algæ gives to pipes and filters makes the prevention of their growth very desirable.

Columns C and D of the second table show the efficacy of the precipitation of bacteria by means of minute quantities of aluminum sulfate and lime. A water which, according to Miguel's standard, would be classified as impure, was changed into one which, according to the same standard, would be classified in one case as pure, and in the other as very pure. In other words, the bacterial content was reduced from that of a polluted river to that of pure spring water. It is also noteworthy that this decrease of bacterial contents reaches its maximum at between twenty-four hours and forty-eight hours, after which a marked increase takes place. This shows that where this method of purification is used on a large scale it is necessary to treat small quantities of water in separate reservoirs, to be used during the following day at latest.

THE OLIVE KNOT.

By F. T. Bioletti.

A bulletin on the olive knot found on the trees in the neighborhood of Merced was issued as No. 120, and of which there are a large number of copies on hand for distribution. It treats of the distribution of the disease; notes on its history; its occurrence in California; and the nature and symptoms of the disease and experiments made in the Station laboratory. The bulletin is illustrated with photographs.

At the time of the publication of this bulletin, though a series of inoculation experiments had been undertaken, it was too early to publish definite results. Since then, results have been obtained that show conclusively the contagious nature of the disease, and which fortify Savastano's opinion that it is due to a specific bacterium.

For these experiments a well-isolated tree was chosen, where there was no danger of spreading the disease. The tree had never been pruned until the year before, when about half of the tree was cut away, with the result that numerous vigorous water-sprouts had grown from the base of the trunk. Six of these suckers were inoculated February 5, 1898, as follows: The first four were inoculated with a decoction made by breaking up a knot in water and pouring the decoction over cuts.

1. Made longitudinal slit through bark.
2. Made eight horizontal cuts through bark.
3. Made deep cut in axil of small branch.
4. Bruised bark with piece of iron.
5. Made an incision in bark and inserted a piece of a knot.
6. Same as No. 5.

On August 13th, Nos. 2, 3, and 4 showed well-developed knots. There was no growth on Nos. 1, 5, and 6. No. 2 showed a knot at each cut, and several more lower down the stem. No. 3 showed a large knot at the point of inoculation. No. 4 showed general infection of all the bruised part, also a large tubercle at the base of the water-sprout. Parallel inoculations were made with pure water instead of the decoction; none of these produced knots.

PLATE 17. Result of Inoculation No. 2.

THE CALIFORNIA VINE-HOPPER.

By Warren T. Clarke.
(Student assistant in Entomology, 1898.)

A bulletin, No. 116, on the subject of the vine-hopper (*Typhlocyba comes*, Say), by Prof. C. W. Woodworth, was issued in 1897, and there are a large number of copies on hand for distribution. In this bulletin many interesting data regarding the habits and life-history of this vineyard pest are given, largely obtained from observation in the field, and in part entirely new. A number of remedies are suggested. The bulletin is illustrated with photographs and drawings.

Since the publication of this bulletin further investigations have been carried on in the field, as opportunity permitted, and in the light of these investigations the bulletin may very properly be modified in some respects and amplified in others.

The Hoppers in Winter. (Bul., page 4).—*The insect does not pass the winter as an egg.* The egg was unknown till the spring of 1899, and now that we know it we can say with more emphasis that in the spring there is no such thing as hatching-out. Work done in the winter with the idea of destroying the eggs is work wasted, as then there are no eggs to destroy.

The insect does not pass the winter in the fallen leaves. A few of the insects may be found in this situation in the spring, but the mass of the insects have deserted the leaves or are dead by midwinter. Field observations made during three winters verify the wholesale destruction, in the fall and early winter, of all stages except a certain proportion of the youngest adult individuals. This occurs every winter, and does not seem to be dependent on the character of the winter. There is a great difference in regard to the numbers of these survivors, but the character of the spring is an important factor in their life-history.

The Hoppers in Spring. (Bul., page 5).—It would appear that sometimes the hoppers are ready for the vines too early. This is especially noticeable in weedy vineyards, from which all the hoppers often disappear before the leaves come out on the vines in the spring. As the vines in cultivated vineyards come out so much earlier than those in weedy, poorly tilled vineyards, the hoppers may, in part, migrate to the well-kept places.

The fact that this insect, though a very general feeder, places its eggs in the grape leaf only, lends strength to the theory that the grape alone furnishes the food suitable for the development of the sexual organs and for the young. Now, if the weather conditions in spring are such as to allow unusual activity on the part of the insect and the starting of the growth of the reproductive organs before proper nourishment is available, much weakness and a high mortality may be looked for.

REMEDIES. (Bul., page 5.)

Sheeping the Vineyard.—Though this has been a favorite remedy, further observations in actual practice seem to confirm the position taken in the bulletin, that so far as the vine-hopper is concerned it is of no avail.

Destroying the Leaves.—This practice, also, from further observations, may be considered as useless, and the statements of the bulletin are confirmed.

Plowing and Rolling.—In this matter, also, further observations confirm the position taken in the bulletin.

Winter Spraying.—Perfectly useless.

Summer Spraying.—In regard to this practice the bulletin says: "Nothing is practical unless it pays"; and these words sum up the desirability of summer spraying. It cannot be recommended as "practical" when the vineyard is in full summer growth. As to making the vines distasteful to the hopper, a series of experiments carried out in the summer of 1899 merely confirm the statements of the bulletin.

Jarring. The Hopper-dozer. The Net.—While these methods of combating the insect may be found practical and satisfactory where we are dealing with completely isolated vineyards, when we begin to deal with large numbers of contiguous vineyards a new element enters into the problem and the methods become useless. Observations prove that the insects occasionally fly in such swarms that the air seems full of them. We have passed through such swarms in the late afternoon an eighth of a mile from the nearest vineyard. Now, though the methods suggested at the head of this paragraph may have been followed up, the labor and expense would be wasted, for the vineyard would soon have a new stock of hoppers gathered from the neighborhood.

Smudges.—A few experiments have been made to test the practicability of heavy smoke to make the hoppers leave any given locality, but so far results have been negative and the method cannot be recommended as practical.

Palliatives.—While the problem of how to destroy the vine-hopper may be considered as yet unsolved, it may not be amiss to here call attention to a method that may be considered as a palliative in certain cases for the injury they do. We refer to the so-called "haying" process. This process so far has been applied to low-pruned vines, such as the Muscatels, only, but in the cases observed has been eminently successful in saving the crop. The method as generally practiced is as follows: From 1½ to 2 pounds of green alfalfa is put on the crown of the vine and twisted to some extent among the spurs, care being taken not to break off the young growth. This work was done (taking a typical case observed by us) shortly after the hoppers had become numerous in the spring. The first crop of grapes clusters about the crown of the vine, and the hoppers attacking the new growth in the spring, cause the leaves to fall that would otherwise have shaded this first crop. The alfalfa seems, in large measure, to take the place of this lost protection, and the result is first-class grapes which would otherwise have been sunburned and shriveled. Any grass, hay, or other available material may be substituted for the alfalfa. The cost in the cases observed came to about $2.50 per acre. This however would depend entirely on the price of the material used. In general it may be said that the results fully justify the outlay. The dry material may be removed when the grapes are picked, and used to pad the vineyard roads. Attention may be here called to the fact that good and thorough care of the vineyard by putting the vine in the best possible condition to resist the damage done by the hoppers must not be neglected. The leaves removed in an attack by them not only would have served as a shade for the grapes but they

had their work to do in the economy of the plant, and their production was an expense to the plant that, owing to their early falling, they had not repaid. This expense should be made good to the plant, if possible, and it can be done to a large extent by thorough cultivation and manuring—in a word by proper farm-practice.

ORCHARD FUMIGATION.

A comprehensive account of the methods of fumigation in use in the southern part of the State is given in Bulletin 122, which has been distributed and of which there are a large number of copies still on hand. In it the cottony cushion scale, the red and black scales, and the San José scale are described. The history and development of the methods of fumigation are given in detail, and then the description and manipulation of the bell tent, the hoop tent, the box tent, the sheet tent; the most economical procedure in application to the trees; and the dose to be given. The bulletin closes with a list of the more important papers that have been written on the subject. It was written by C. W. Woodworth, and is generously illustrated with photographs.

SPRAYS AND WASHES.

By C. W. Woodworth.

Water alone, applied with some force, will dislodge a good many insects, but most pests require the addition of some more active principle to the wash. The formulas below give the amounts necessary to make an oil-can full (5 gallons), and also a barrel-full (40 gallons) of each mixture. Spray with heavy pressure for scale insects and make everything thoroughly wet; but for other pests less pressure and material are necessary, for the leaves should scarcely be made to drip.

FOR INSECTS THAT EAT THE LEAVES AND FRUIT.

Use a poison sprayed on the foliage to kill the insects when they eat it.

Name of Wash.	Ingredients.	For 5 Gals.	For 40 Gals.	Directions.
Paris Green	Paris Green	¾ oz.	6 oz.	Add the Paris Green to the cold, strained lime water. Keep constantly stirring while spraying.
	Lime	8 oz.	4 lbs.	

FOR SCALE AND OTHER INSECTS.

Use mixtures which kill by coming in contact with the body of the insect while the plants are being sprayed.

Name of Wash.	Ingredients.	For 5 Gals.	For 40 Gals.	Directions.
Kerosene Emulsion	Kerosene Sour Milk or Soap	3 pints 1½ pints 1½ oz.	3 gals. 1½ gals. ¾ lb.	Mix hot by pumping through a spray-pump for fifteen minutes, then dilute. Use either sour milk or soap solution. One half as strong will do for plant-lice. Twice as strong is safe when the leaves are off. An emulsion is more easily made if about twelve times as much soap is used.
Rosin Soap	Rosin Caustic Soda Fish Oil	1 lb. ¼ lb. 2 oz.	8 lbs. 2 lbs. 1 pint	Boil two hours with a small quantity of water, then dilute with warm water. It may be used one half stronger when the leaves are off. It is cheaper than the emulsion.

FOR SCALE INSECTS, FUNGI, AND MOSS.

Use mixtures applied in winter which corrode the dead bark, and so soften it, as well as kill insects by contact.

Name of Wash.	Ingredients.	For 5 Gals.	For 40 Gals.	Directions.
Lime-Salt and Sulfur	Lime Salt Sulfur	3 lbs. 1 lb. 1½ lbs.	24 lbs. 8 lbs. 12 lbs.	Boil two hours with a small quantity of water, then dilute. This is for winter use only. If the salt is omitted and a third less of the other ingredients used, it will not injure foliage.
Sulfid of Potash	Caustic Soda Potash Sulfur Whale-Oil Soap	¾ oz. ¾ oz. 2¼ oz. 1 lb.	6 oz. 6 oz. 18 oz. 8 lbs.	Add the dissolved whale-oil soap after boiling the rest one hour; then boil all one half hour and dilute. This is for winter use only. If the whale-oil soap is omitted and one fourth as much of the other ingredients used, it will not injure foliage.

FOR FUNGI.

Use mixtures that will prevent the germination of the spores on the leaf.

Name of Wash.	Ingredients.	For 5 Gals.	For 40 Gals.	Directions.
Bordeaux Mixture	Bluestone Lime	½ lb. ½ lb.	4 lbs. 4 lbs.	Dissolve the bluestone and slake the lime *separately*. Mix when cool. The amount of lime may be increased if desired. When the leaves are off the trees the mixture may be used two or three times as strong.
Ammonia-Copper Carbonate	Ammonia Copper Carbonate or Bluestone Sal Soda	5 oz. ½ oz. ¾ oz. 1 oz.	2½ pints ¼ lb. 6 oz. ½ lb.	If the bluestone and sal soda are used, dissolve them *separately* in a small quantity of water and mix when cool. The copper carbonate thus produced is then dissolved in ammonia. Do not dilute with water till it is all dissolved. It is not so good as Bordeaux mixture, but does not discolor the leaves.

SPECIMENS RECEIVED FOR EXAMINATION BY THE BACTERIOLOGICAL LABORATORY.

By Frederic T. Bioletti.

Of the many specimens and samples received at the Bacteriological Laboratory the greater number are of but passing or personal interest. Those of more general interest are reported on below:

Diseased Violet Leaves, from W. A. Pischett, Santa Monica, November 22, 1897. Attacked by the violet leaf spot (*Cercospora violæ* and *Phyllosticta violæ*). The disease forms white spots on the leaves. These spots generally have black dots on them which are thickest near the center, and form a smaller black spot in the center of the white spot. As the disease progresses the spots enlarge and become yellowish, gradually invading a large part or all of the leaf. Weak Bordeaux mixture applied several times at intervals of ten days, has been found useful for this disease. However, as the fungus grows inside the leaf it is almost impossible to cure plants once badly attacked. The spraying will to some extent prevent the disease from spreading, and no plants should be taken from infected spots to plant new beds.

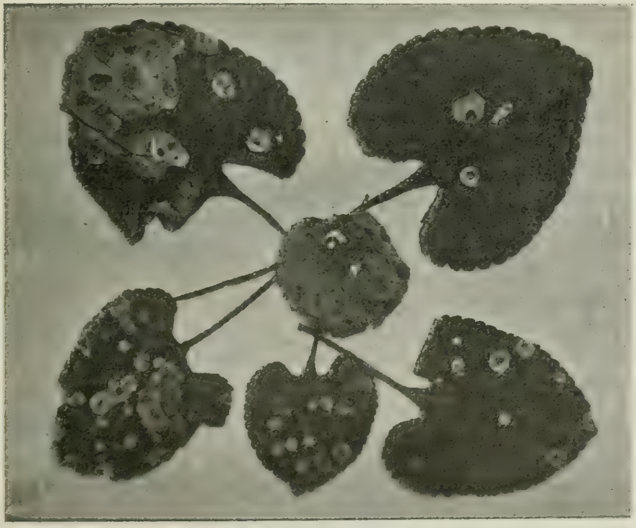


PLATE 18. Leaf Spot of Violet.

Diseased Vines from E. and J. Bender, Morgan Hill, Cal., January 15, 1898. The main roots of the vines were quite dead and only some small new ones were living. The trunk and branches showed no evidence of disease except the short growth of the previous year. Many of the small and medium-sized roots were covered with a fungus felt beneath the bark. The fungous threads extended into the wood and all the roots had a strong fungous smell. The vines were evidently killed by "fungous root rot" (toadstool fungi), which so often attacks vines

and trees planted in places from which oak trees have been removed. There is no known cure, for the vine is thoroughly invaded by the fungus before the disease shows its presence perceptibly by its effect on the above-ground portion of the vine. As a preventive measure, trees, especially oak trees, should be grubbed out as deeply as practicable and all the wood, chips, and twigs removed or burnt. For it is the fungi which grow in the decaying wood that attack the vine. A new vine planted where the old one has died is nearly always killed in the same way. The best method is to dig a large hole—three feet deep and correspondingly wide, spray the sides and bottom with bluestone dissolved in water (1 pound to 10 gallons), and fill the hole with top soil from an uninfected place. A vine may then be planted with little danger.

Diseased Prune branches from R. V. Sharp, Hanford. The branches were affected by "crater-blight." Inoculation into various media failed to show the presence of any organism.

Frozen and Unfrozen Oranges from the same tree were received January 17, 1898, with the request to determine whether the cells of the frozen oranges had burst, and whether this was the cause of the rapid drying-up of the frozen fruit. Microscopic examination showed no difference in the cells of the two kinds. Pieces of the flesh of both kinds were placed in a water solution containing 33 per cent of cane sugar, and other pieces in distilled water. The next day the cells of both kinds in the sugar solution had shrunk equally, while the cells of those in distilled water had swollen equally; indicating that there were no breaks in the cell walls of the frozen oranges.

Diseased Vine from C. H. Wente, Livermore, February 9, 1898. Roots showed phylloxera.

Zante Currants.—A sample of currants grown and dried in California by R. W. Ketcham near Jackson was received from M. Rust. The currants were poorly dried but were well-flavored.

Diseased Olive Twigs from Board of Horticulture, Kings County. Twigs were half dead and with peculiarly loosened bark, but nothing to show the cause of injury.

Diseased Pork from J. H. Oester, O'Neals, Madera County, March 20, 1898. Pieces of muscle and heart contained large numbers of bladder worms. Sender advised to cook thoroughly before giving to chickens, as he had intended.

Diseased Vines from B. Bruck, St. Helena, April 12, 1898. The vines were supposed to have the *Anaheim disease*, but simply showed yellow and red blotches on the leaves. This appearance is very similar to that of the Anaheim disease, and occurs often in some seasons in the northern coast county vineyards, but does apparently little or no harm except to an occasional vine.

Grape Canes covered with scale, from C. Nisson, Petaluma, May 16, 1898. The scale is *Pulvinaria innumerabilis*, one which attacks many plants, and one of the few that ever injures vines. It is to be controlled by general scale remedies. A strong winter wash, immediately after pruning, would be effective.

Vine Roots from B. W. Paxton, Healdsburg, May 24, 1898. No phylloxera could be found on the roots.

Vine Leaves from R. L. Nougaret, 586 Tenth Street, Oakland, May 28, 1898. The leaves were from Chasselas vines in Knights Valley, Sonoma County, and showed the attacks of some spot fungus, probably *Septoria ampelina*, a disease not dangerous.

7. VITICULTURE.

THE CONTROL OF TEMPERATURE IN WINE FERMENTATION.

A bulletin on this subject by A. P. Hayne (No. 117), was issued in 1897, and a number of copies remain on hand for distribution. It treats of the percentage of sugar; excess of heat; activity of yeast; nourishment; diseases of wine; importance of proper temperature; paralysis and death of yeast plants; use of antiseptics and anti-ferments; stuck tanks; methods of reducing temperature; description of the apparatus used in other countries; experiments made by the Station at Natoma and Evergreen, California; and a description of the new apparatus used in these experiments.

VINE PRUNING.*

By Frederic T. Bioletti.

The literature relating to the pruning and training of the vine is already very voluminous, but there seems to be no one work which treats the subject in a thorough and convenient way for California vine-growers. Publications in English refer generally to methods suited to the Eastern States or to hot-house cultivation, while foreign publications, besides being more or less inaccessible, treat the subject so widely that the grower is at a loss what to choose in such a mass of material. It is the purpose of this article, therefore, to present a brief summary of what in foreign methods seems useful and applicable to California conditions, together with the results of experiments on the University of California vine plots, and of observations made in numerous vineyards in various regions of the State.

Almost every vine-growing district has its peculiar systems of training, ranging from the non-training, usual in parts of Italy where the vine spreads almost at will over trees planted for the purpose, to the acme of mutilation practiced in many localities where the vine is reduced to a mere stump barely rising above the surface of the ground. These various systems will not be discussed here, but only those which experience has shown to be best adapted to California conditions.

No account, however detailed, of any system can replace the intelligence of the cultivator. For this reason the general principles of plant physiology which underlie all proper pruning and training are discussed

*Revision of Bulletin 119.

in connection with the several systems described. This should aid the grower in choosing that system most suited to the conditions of his vineyard, and to modify it to suit special conditions and seasons. All the operations of pruning, tying, staking, etc., to which a cultivated vine owes its form are conveniently considered together.

No cultivated plant is susceptible of such a variety of modes of training as the vine, and none can withstand such an amount of abuse in this matter and such radical interference with its natural mode of growth. On the other hand, no other plant, perhaps, is so sensitive to proper treatment, or responds so readily to a rational mode of pruning and training.

Objects of Pruning.—The objects of pruning are (*a*) to facilitate cultivation and gathering, (*b*) to increase the average yield, and (*c*) to improve the quality of fruit. The vine must not be trained so high that the grapes are difficult to gather, nor allowed to spread its arms so wide that the cultivation of the ground is unduly interfered with. Vines untouched by the pruner's knife bear irregularly; a year of over-bearing being followed by several of under-bearing, as a consequence of exhaustion caused by a too severe drain on the reserve forces of the plant. The grapes on untrained or improperly trained vines are exposed to different conditions of heat and light, and consequently develop and ripen unevenly.

Physiological Principles.—The main facts regarding the physiology of the vine to be kept in mind in this connection are:

1. The vine feeds by means of the green coloring matter (chlorophyll) of its leaves. It obtains the sugar, starch, etc., which it needs, from the carbonic acid of the air which is converted into these substances by the chlorophyll under the influence of light. A certain amount of green leaf-surface, functioning for a certain time, is necessary to produce sufficient nourishment for the vital needs of the vine and for the production of a crop. Those leaves most exposed to the direct rays of the sun are most active in absorbing food. The youngest leaves take all their nourishment from the older parts of the plant; somewhat older leaves use up more nutrient material in growing than they absorb from the air. A young shoot may thus be looked upon as, in a sense, parasitic upon the rest of the vine. The true feeders of the vine and of its crop are the *mature, dark-green leaves.*

2. Within certain limits the fruitfulness of a vine or of a part of a vine is inversely proportional to its vegetative vigor. Methods which tend to increase the vegetative vigor of a vine or of a part of a vine tend to diminish its bearing qualities, while, on the contrary, anything which diminishes vegetative vigor tends to increase fruitfulness. Failure to reckon with this fact and to maintain a proper mean between the two extremes leads, on the one hand, to comparative sterility, and, on the other, to over-bearing and premature exhaustion.

3. The vine tends to force out terminal buds and to expend most of its energy on the shoots farthest from the trunk. To keep the vine within practical limits, this tendency must be controlled by the removal of the terminal buds, or by measures which check the flow of sap and force the growth of buds nearer the stock.

4. The nearer a shoot approaches the vertical the more vigorous it will be.

5. The size of shoots and of fruit is, within certain limits, inversely as their amount. That is, with a given vine, or arm of a vine, the fewer shoots allowed to grow the larger each will be, and the same is true of bunches of fruit.

6. Other conditions being equal, an excess of foliage is accompanied by a small amount of fruit; an excess of fruit by diminished foliage.

7. Shoots coming from one-year-old wood growing out of two-year-old wood are alone to be depended on for fruit. Other shoots are usually sterile.

8. Bending, twisting, or otherwise injuring the tissues of the vine or its branches tend to diminish its vegetative vigor, and therefore, unless excessive, to increase its fertility.

A description of a typical vine giving the names of the principal parts, will make clear the accounts of methods to be given later. Fig. I represents a vine of no particular order of pruning, showing the various parts. The main body of the vine (T) is called the trunk or stem; the principal divisions (B) branches; the smaller divisions (A) arms, and the ultimate

Fig. I

ramifications (C) shoots when green, and canes when mature. A shoot growing out of the vine above ground on any part older than one year (WS) is called a water-sprout. Shoots coming from any part of the vine below ground (S) are called suckers. When a cane is cut back to one, two, three, or four eyes it is called a spur (R). When a shoot or cane of one season sends out a secondary shoot the same season, the latter (L) is called a lateral.

Fig. II represents an arm of a vine as it appears in winter after the leaves have fallen. The canes (W^1) are the matured shoots of the previous spring. W^2, W^3, W^4 represent two, three, and four-year-old wood respectively. Near the base of each cane is a basal bud or eye (B°). In counting the number of eyes on a spur the basal eye is not included. A cane cut at K^1 for instance leaves a spur of one eye, at K^2 a spur of two eyes, and so on. When more than four eyes are left the piece is generally called a fruiting cane (Fig. I, F). The canes (C, C^1) coming from two-year-old wood (W^2) possess fruit buds; that is, they are capable of producing fruit-bearing shoots. Water-sprouts (WS) and suckers (S) do not ordinarily produce fruit-bearing shoots. Below the basal bud each cane has one or more dormant buds (b, Fig. III), which do not

grow unless the number of eyes left by pruning or frost is insufficient to relieve the excess of sap pressure. These buds produce sterile shoots. Each eye on a cane has, at its base, two dormant buds. One of these sometimes grows out the year it is formed, making a lateral (L, Figs. I, II). These laterals may send out secondary laterals (SL, Fig. I). It is on the laterals and secondary laterals that the so-called second and third crops are borne.

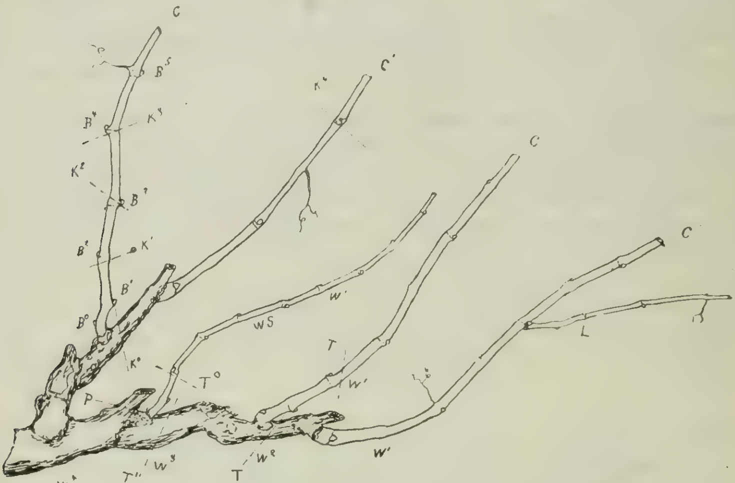
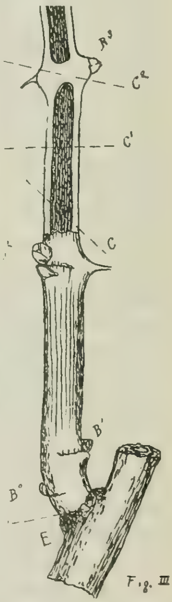


Fig. II

Pruning for Wood and for Fruit.—One of the chief aims of pruning is to maintain a just equilibrium between vegetative vigor and fertility. We must, then, prune for both wood and fruit. A vine which has become enfeebled by over-bearing, drought, disease, or other unfavorable conditions, should be pruned for wood. By this is meant that only a small number of buds should be left. As all the energies of the vine have to be expended on a small number of shoots, these shoots grow with more than ordinary vigor. Under these conditions the vine bears little; first, because the eyes near the bases of the canes, which are the only ones left in very short pruning, are naturally less fruitful than those farther removed from the main body of the vine; and second, because an exceptionally vigorous shoot is generally sterile. The vine is thus strengthened, and, as the stores of nutriment provided by a vigorous vegetation are not drawn upon by a heavy crop, the increased vigor of the vine is more marked the second year. The second year, therefore, more wood may be left and the crop increased without detriment to the vine.

On the other hand, a vine which "goes to wood" must be pruned for fruit. For this purpose we increase the number of buds left, and choose the most fruitful wood. The largest canes are the least fruitful, while the smallest have not the necessary vigor to support a large crop. The best cane to leave for fruit then is one of medium size, with well-formed eyes.

Proper Method of Making Cuts.—It is by no means a matter of indifference just where the cut is made in removing a cane or arm. This will be made clearer by referring to Fig. III. The upper part of the spur is represented as split in two longitudinally in order to show the internal structure of the cane. It will be noted that at each bud there is a slight swelling of the cane. This is called a node, and the space between, an internode. The internodes are filled with soft pith, but at each node there is a growth of hard wood extending through the cane. Now, if the cane be cut off at C^1, in the middle of an internode, the pith will shrink away and leave a little hollow in which the rain collects. This is an excellent breeding-place for fungi and bacteria, which cause rotting of the pith and frequently kill the bud. If, on the contrary, the cane be cut at C^2, through a node, a protecting cover of hard wood is left, which is an effectual barrier against decay organisms. If a spur projects too far from the vine and it is desirable to make it as short as possible in order not to interfere with cultivation, it should be cut at C and the cut made as nearly vertical as possible. This allows the water to run off, and leaves less pith to foster the growth of the fungi. At the base of the cane there is a slight enlargement (E). In removing a cane completely the cut should be made just above this enlargement. This is the most favorable place for healing, as it makes the smallest possible wound and does not leave a projecting stump of dead wood to prevent the healing tissues from closing over the wound. In removing a piece of older wood, as at K^0 and T^1, Fig. II, it is advisable not to cut too close for fear of injuring the spur by the drying-out of the wood. The projecting pieces of dead wood left in this way should be carefully removed the next year in order to allow the wound to heal over. The large cuts which are thus occasionally necessary are most easily performed by means of a well-made and well-sharpened pair of two-hand pruning-shears. These shears are often to be preferred to the ordinary one-hand shears, because they render the cutting through the nodes easier, and do away almost entirely with the necessity of a saw. Of course, a careless workman may split and injure vines seriously by using long-handled shears clumsily, but the bending of arms to facilitate cutting with the one-hand shears often results in the same evil. The one-hand shears, however, are more convenient when many long fruiting-canes are left, as the necessary trimming off of tendrils and laterals is more easily performed with them.



Short and Long Pruning.—The winter pruning of the vine consists in cutting off a certain amount of the mature wood of the immediately preceding season's growth (canes), and occasionally of the older wood. The main problem of winter pruning, then, resolves itself into determining how much and what wood shall be left. In all kinds of pruning most of the canes are removed entirely. In *short pruning* the remainder are cut back to spurs of one, two, or three eyes. The number of spurs is regulated by the vigor and age of the vine. This mode of pruning can be used only for varieties in which the eyes near the base of the cane are fruitful, and of which the bunches are large. For all other cases long or half-long pruning is necessary.

In *half-long pruning* certain canes are left with from four to six eyes, according to the length of the internodes. These canes or fruit-spurs will bear more fruit than short spurs, for three reasons: (1) Because there will be more fruit-bearing shoots; (2) Because the upper eyes are more fruitful than the lower; and (3) Because a large number of eyes being supplied with sap from the same arm, each shoot will be less vigorous and therefore more fruitful. Owing, however, to the tendency of the vine to expend the principal part of its vigor on the shoots farthest removed from the base of the canes, the lower eyes on the long spurs will generally produce very feeble shoots. In order, then, to obtain spurs of sufficient vigor for the next year's crop it would be necessary to choose them near the ends of the long spurs of the previous year, if no others were left. This would result in a rapid and inconvenient elongation of the arms. In order to avoid this it is necessary to leave a spur of one or two eyes below each long fruiting spur, that is to say, nearer the trunk. These short wood spurs having only one or two eyes, will produce vigorous canes for the following year, and the spurs which have borne fruit may be removed altogether, thus preventing an undue elongation of the arms. In half-long pruning, however, it is very hard to retain the proper equilibrium between vigor and fruitfulness. If a little too much wood is left, the shoots from the wood spurs will not develop sufficiently, and the next year we have to choose between leaving small, under-sized spurs near the trunk, and spurs of proper size too far removed from the trunk. In long pruning, this difficulty, as will be seen, is to a great extent avoided.

In *long pruning*, the fruit spurs of half-long pruning are replaced by long fruit canes. These are left two or three feet long, or longer. The danger that the vine will expend all its energies on the terminal buds of these long canes and leave the eyes of the wood spurs undeveloped, is here still greater than in half-long pruning. This difficulty is overcome by bending or twisting the fruit canes in some manner. This bending causes a certain amount of injury to the tissues of the canes, which tends to check the flow of sap towards their ends. The sap pressure thus increases in the lower buds and forces them out into strong shoots to be used for spurs for the next pruning. The bending has the further effect of diminishing the vigor of the shoots on the fruit canes, and thus increasing their fruitfulness.

This principle of increase of fruitfulness by mechanical injury is very useful if properly understood and applied. It is a well-known fact that vines attacked by phylloxera or root rot will for one year bear an exceptionally large crop, on account of the diminution of vigor caused by the injury to their roots. A vine also which has been mutilated by the removal of several large arms, will often produce heavily the following year. In all these cases, however, the transient gain is more than counterbalanced by the permanent injury and loss. The proper application of the principle is to injure tissues only of those parts of the plant which it is intended to remove the next year (fruit canes), and thus increase fruitfulness without doing any permanent injury to the plant.

Pruning of Young Vines.—When a rooted vine is first planted, it should be cut back to two eyes. If the growth is not very good the first season, all the canes but one should be removed at the first prun-

ing, and that one left with two or three eyes, according to its strength. The next year, or the same year in the case of strong growing vines in rich soil, the strongest cane should be left about twelve inches long and tied up to the stake. The next year two spurs may be left, of two or three eyes each. These spurs will determine the position of the head or place from which the arms of the vine spring. It is important, therefore, that they should be chosen at the right height from the ground. From ten to twenty inches is about the right height; the lowest, for dry hillsides where there is no danger of frost; the highest, for rich bottom lands where the vine will naturally grow large. Vines grown without stakes will have to be headed lower than this in order to make them support themselves. In the following few years the number of spurs should be increased gradually, care being taken to shape the vine properly and to maintain an equal balance of the arms.

In general, young vines are more vigorous than old, and tend more to send out shoots from basal and dormant buds. They should, therefore, be given more and longer spurs in proportion than older vines. They also tend to bud out very early in the spring, and are thus liable to be frost bitten. For this reason they are generally pruned late (March) in frosty locations. This protects them in two ways. In the first place, in unpruned vines, the buds near the ends of the canes start first and relieve the sap pressure, and though these are caught by the frost the buds near the base, not having started, are saved. In the second place, the pruning being done when the sap is flowing, there is a loss of sap from the cut ends of the spurs, which further relieves the sap pressure and retards the starting of the lower eyes. This method of preventing the injury of spring frosts by very late pruning has been tried with bearing vines, but is very injurious. Older vines being less vigorous are unable to withstand the heavy drain caused by the profuse bleeding which ensues; and though no apparent damage may be done the first year, if the treatment is continued they may be completely ruined in three or four years.

SYSTEMS OF PRUNING.

The systems of pruning adapted to vineyards in California may be divided into six types, according to the form given to the main body of the vine and the length of the spurs and fruiting canes:

A. *Vine pruned to a head, with short arms.*

- I. With spurs of one or two eyes only (short pruning).
- II. With wood spurs of one or two eyes, and fruit spurs of four to six eyes (half-long pruning).
- III. With wood spurs of one or two eyes, and long fruit canes (long pruning).

B. *Vine with a long horizontal branch or continuation of the trunk.*

- IV. With spurs of two or three eyes only (short pruning).
- V. With wood spurs of one or two eyes, and fruit spurs of four to six eyes (half-long pruning).
- VI. With wood spurs of one or two eyes, and long fruit canes (long pruning).

These types are applicable to different varieties of vines according (1) to the natural stature of the vine—that is to say, whether it is a large or small grower, and whether it tends to make a large, extended trunk or a limited one; (2) to the position of the fruit buds. In some varieties all the buds of the canes are capable of producing fruitful shoots, while in the others the one, two, or three buds nearest the base produce only sterile shoots; (3) to the size of the individual bunches. It is necessary in order to obtain a full crop from a variety with small bunches, to leave a larger number of eyes than is necessary in the case of varieties with large bunches.

What type or modification of a type shall be adopted in a particular instance depends both on the variety of vine and on the nature of the vineyard. A vine growing on a dry hillside must not be pruned the same as another vine of the same variety growing on rich bottom land. In general, vines on rich soil, where they tend to grow large and develop abundant vegetation, should be given plenty of room and allowed to spread themselves, and should be given plenty of fruiting buds in order to control their too strong inclination to "go to wood." Vines on poor soil, on the contrary, should be planted closer together and pruned shorter, or with fewer fruiting buds, in order to maintain their vigor.

Type I.—This is the ordinary short pruning practiced in 90 per cent of the vineyards of California, and is the simplest and least expensive manner of pruning the vine. It is, however, suited only to vines of small growth, which produce fruitful shoots from the lowest buds, and of which the bunches are large enough to admit of a full crop from the small number of buds which are left by this method. The chief objection to this method for heavily bearing vines is that the bunches are massed together in a way that favors rotting of the grapes, and exposes the different bunches unequally to light and heat.

Fig. IV represents the simplest form of this style of pruning. The vine should be given, as nearly as possible, the form of a goblet, slightly flattened in the direction of the rows. It is important that the vine be kept regular and with equally balanced arms. This is the chief difficulty of the method and calls for the exercise of some judgment. From the first, the required form of the vine should be kept in view. On varieties with a trailing habit of growth, vertical spurs must be chosen, and with some upright growers it will be found necessary to choose spurs nearer the horizontal.

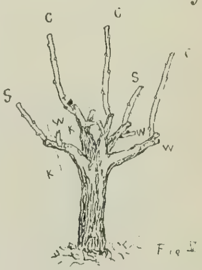
Fig. IV.

The arms must be kept short for convenience of cultivation and to give them the requisite strength to support their crop without bending or breaking. For this reason the lowest of the two or three canes coming from last year's spur should be left. For instance, on Fig. II the cane should be cut at K^2 or K^3, according as two or three eyes are needed, and the rest of the arm removed at K^0. As even with the greatest care some arms will become too long or project in wrong directions, it is necessary to renew them by means of canes from the old

wood or water sprouts. For instance, if the other arm represented in Fig. II were too long, it should be removed and replaced by another developed from the cane (WS). As the cane comes from three-year-old wood it cannot be depended on to produce grapes. For this reason it is best the first year to prune the arm at T, leaving a spur for fruit, and cut the water-sprout at T°, leaving a wood spur of one eye. The next year the cane coming from the first eye of WS can be left for a fruit spur, and the arm removed at T^1. The cutting back of an elongated arm should not be deferred too long, as the removal of old arms leaves large wounds which weaken the vine and render it liable to attacks of fungi.

In order to maintain the equilibrium of the arms it is often necessary to prune back the more vigorous arms severely in order to throw the strength of the vine into the weaker arms. If the vine appears too vigorous, that is if it appears to be "going to wood" at the expense of the crop, two spurs may be left on some or all of the arms. In this case the upper spur should be cut above the third eye (K^4, Fig. II), and the lower above the first or second (K^1 or K^2). This will cause the bulk of the fruit to be borne on the upper spur, and the most vigorous shoots to be developed on the lower, which provides the wood for the following year. This is an approach to the next (half-long) method of pruning.

Type II.—Vines which require more wood than can well be given by ordinary short pruning, or of which the lower eyes are not sufficiently productive, may in some cases be pruned in the manner illustrated by Fig. V. For some varieties it is necessary to leave spurs of only three eyes, as at S; for others, short canes of four or five eyes must be left, as at C C. These shorter spurs can be left without support, but the longer ones require some arrangement to prevent their bending over with the weight of fruit and destroying the shape of the vine. In some cases simply tying the ends of the canes together will support them fairly well, but it is better to attach them



to a stake and bend them at the base a little, when possible, in order to retard the flow of sap to the ends. It is very necessary to leave strong spurs of one eye (not counting the basal eye) in order to provide wood for the following year. At the pruning following the one represented in the cut, the fruiting part of the arms will be removed at K K and a new fruiting spur or cane made of the cane which comes from the eye on the wood spurs W. The basal bud on W will in all probability have produced a cane which can be cut back to one eye to furnish a new wood spur. If this is not the case it shows that too much wood was left the first year, and therefore no fruit cane should be left on this arm, but only a single spur of two or three eyes. This will be a return to short pruning, and must be resorted to whenever the small size of the canes or the failure to produce replacing wood near the head of the vine shows that the vigor is diminishing. If, on the contrary, the arm shows an abundance of vigorous canes, proving that the vine has not overborne, a fruit cane may be left from one of the shoots coming from the lower buds of the fruit cane C, and a new wood spur of two eyes left on the shoot coming from the wood spur of the previous year (W). In this

case, the removal of the arm at K is deferred one year, and the extra vigor of the vine is made use of to produce an extra crop.

Type III.—This style is an extension of the principles used in Type II, as will be understood by referring to Fig. VI. The fruiting canes are left still longer, and in some cases almost the full length of the cane. As each cane will thus produce a large amount of fruit, fewer arms are necessary than in the preceding method. It is especially necessary to leave good, strong spurs of one or two eyes to produce wood for the following year. There are various methods of disposing of the long fruiting canes, the worst of which is to tie them straight up to the stake,

Fig. VI

as was recommended for the half-long canes. In the latter case, owing to their shortness, a certain amount of bending of the canes is possible with this method of tying. With long canes, on the contrary, it usually allows of no bending sufficient to check the sap, and as a result there ensues a vigorous growth of shoots at the ends of the fruiting canes, and little or no growth in the parts where it is necessary to look for wood for the following year. Often, indeed, each long cane will produce only three shoots and these from the three terminal eyes, all the other eyes of the cane remaining dormant. The object of long pruning is thus doubly defeated, first, because no more shoots are produced than by short pruning; and second, because the shoots which should produce fruit are rendered especially vigorous by their terminal and vertical position, and, therefore less fruitful. Each year all this vigorous growth of wood at the ends of the canes must be cut away in order to keep the vine within practical bounds, and the fruit canes renewed from the less vigorous cane below. These canes are less vigorous because the main strength of the vine has been expended on the upper canes which are most favorably placed for vegetative vigor. Vines treated in this way may be gradually exhausted though producing only a moderate or small crop of fruit, by being forced to produce a too abundant crop of wood.

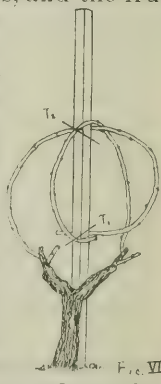


Fig. VII

One of the simplest ways of tying the fruiting canes is illustrated by Fig. VII. The canes are bent into a circle, the ends tied to the stake near the head of the vine, and the middle of the circle attached higher up. The tying should be done so that the cane receives a severe bend near the base—that is, about the region of the second and third eyes. This can usually be accomplished by tying the end of the cane first, and then pressing down on the middle of the bow until the desired bend is attained. If two fruiting canes are left, they should be made to cross each other at right angles in order to distribute the fruit as equally as possible. As a rule more than two canes should not be tied up in this way, as it makes too dense a shade and masses the fruit too much.

Fig. VIII shows another method of tying the long canes. A horizontal wire is stretched along the row at about fifteen to twenty inches above the ground. To this the fruiting canes should be attached, using the same precaution of bending the canes near the bases. The upper part of the canes is not bent in this case as in the last, but the necessary diminution of vigor and increase of fruitfulness is brought about by the horizontal position. Two canes may be attached to the wire on each side. The stake is used to support the shoots destined for the wood for the following year. This makes it possible, where topping is practiced, to cut off the ends of the green shoots from the fruiting canes in summer and to leave the rest their full length. Another or even two other wires

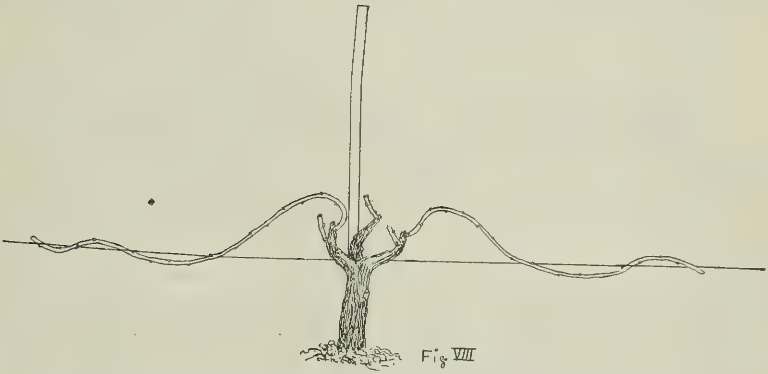


Fig. VIII

may be used above the first for more canes, but this is seldom profitable, and considerably increases the cost both of installation and of pruning.

This style of pruning is especially favorable to varieties of small growth which bear small bunches and principally on the upper eyes, and to varieties of larger growth in hilly or poor soils. One of its main objections is that it renders some varieties more liable to sunburn.

It will be noticed that the long-pruned vines are represented in the figures as having much fewer arms than the short-pruned. This is necessary and important. In order to maintain a well-balanced vine and keep it under control, there should be only about as many arms as long canes, or at most one or two more.

Types IV, V, and VI.—The three styles of pruning so far described have been fairly thoroughly tested in California, and each has been found applicable to certain varieties and conditions. There are some varieties, however, which do not give good results with any of these systems. This is the case with many valuable table grapes, especially when grown in rich valley soil, where they should do best. For these cases some modification of the French cordon system is to be recommended. Little trial of this method has been made as yet, but what has been done is very promising. The tendency of many grapes to coulure is overcome, and rich soils are made to produce crops in proportion to their richness. The method consists essentially in allowing the vine to grow in a more or less horizontal direction for several feet, thus giving a larger body and fruiting surface.

The treatment of the young vines the first year is the same as for head pruning, as already described. As soon as the young vine produces a good, strong shoot it is tied up to the wire and to the stake

which is placed between the vines in the rows. Each vine should finally reach its neighbor, but it requires two or three years for this if the vines are six or seven feet apart in the rows. It is possible, by cutting the vine back nearly to the ground for the first year or two, to obtain a cane which will stretch the whole distance between the vines at the first tying up; but this is not necessary nor advisable. Neither is it advisable to make a very sharp angle (almost a right angle) as is usually done in regular cordon pruning, on account of

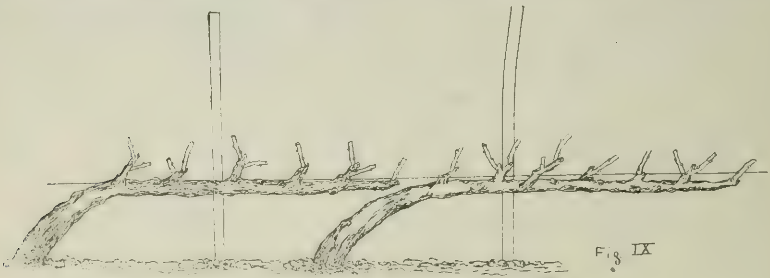


Fig. IX

the difficulty of preventing the vine from sending out an inconvenient number of shoots at the bend. The vine might be grown with two branches, one stretching in either direction, but this has been found inconvenient on account of the difficulty of preserving an equal balance of the branches. The direction in which the vine is trained should be that of the prevailing high winds, as this will minimize the chances of shoots being blown off. When the cordon or body of the vine is well formed, it may be pruned with all the modifications of short, half-long, and long pruning already described in head pruning, and the same precautions are necessary to preserve the balance and symmetry of the vine and to maintain it at the highest degree of fruitfulness without unduly exhausting it.

Fig. 10

Figs. IX and X will sufficiently illustrate the way of shaping and tying short and long pruned vines. For some table grapes extension of the method shown in Fig. IX in the direction of half-long pruning is useful. On a heavy soil the short spurs do not provide sufficient outlet for the vigor of the vine, while long pruning would unduly increase the number of bunches on a single cane, and so reduce their size, which would deteriorate from their value as table grapes.

Fig. XI represents a style of pruning used with success in some of the richest low-lying soils of France. The body of the vine is raised up to a height of two and a half or three feet above the soil, a useful means of lessening the danger from spring frosts. The fruit canes are bent vertically downward, thus restricting the flow of sap sufficiently to force out the lower buds of the fruit canes into strong shoots, which can be used for fruit canes of the following year. This does away, to some extent, with the necessity of leaving wood spurs, and much simplifies the pruning. Arms, of course, are formed in time, and very gradually elongate, so that it is necessary to remove one occasionally and replace it by a water-sprout, as already explained under short pruning.

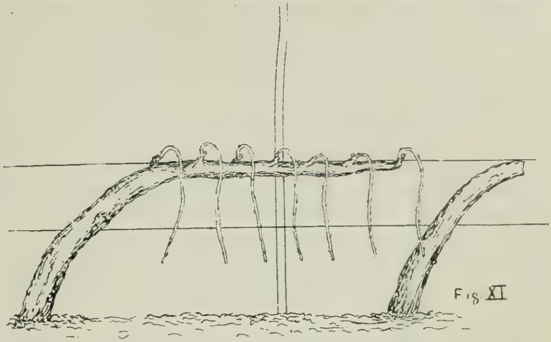


Fig. XI

SUMMER PRUNING.

Some form of summer or green pruning is practiced in most California vineyards, if in the term we include all the operations to which the green shoots are subjected. There seems, however, to be little system used, and very little understanding of its true nature and object. In general, it may be said that green pruning of the vine is least needed and often harmful in warm, dry locations and seasons, and of most use under cool and damp conditions.

The principal kinds of green pruning are: 1. Pinching; 2. Suckering and sprouting; 3. Topping; 4. Removal of leaves.

Pinching consists in removing the extreme growing tip of a young shoot. It is necessary to remove only about half an inch to accomplish the purpose of preventing further elongation of the shoot, as all growth in length takes place at the extreme tip. The immediate result of pinching is to concentrate the sap in the leaves and blossoms of the shoot, and finally to force out the dormant buds in the axils of the leaves. It has been found useful in some cases to combat coulure or dropping with heavy-growing varieties, such as the Clairette Blanche. It is also of use in preventing unsupported shoots from becoming too long while still tender, and being broken off by the wind. It can, of course, be used only on fruiting shoots, and not on shoots intended for wood for the following year.

Suckering is the removal of shoots that have their origin below or near the surface of the ground. The shoots should be removed as thoroughly as possible, the enlargement at the base being cut off in order to destroy the dormant basal buds. An abundant growth of suckers indicates either careless suckering of former years (which has allowed a mass of buds below the ground, a kind of subterranean arm, to develop), or too limited an outlet for the sap. The latter may be due to frost or other injuries to the upper part of the vine, but is commonly caused by too close pruning.

Sprouting is the removal of sterile shoots or "water-sprouts" from the upper part of the vine. This is generally an unnecessary and often a harmful operation, especially in warm dry locations. In some cases, however, it is necessary, as with such varieties as the Muscat of Alexandria, which has a strong tendency to produce large numbers of water-sprouts, which, growing through the bunches, injure them for table and drying purposes. Occasionally it is useful when it is desired to increase the size and vigor of certain shoots. When the buds of the spur left in winter pruning fail to start on account of some injury or disease, or when after starting they are killed by frost or insects, a large number (6 to 12) of water-sprouts will often start from the base of the injured spur. If all these are allowed to grow none of them, in most cases, will be strong enough to be left for a spur the next year. It is well, therefore, to remove all these water-sprouts but one or two. Those left will be more vigorous and will furnish good spurs for the following pruning.

Water-sprouts are produced from dormant buds in the old wood, and as these buds require a higher sap pressure to cause them to start than do the fruitful buds, the occurrence of many water-sprouts indicates that too limited a number of fruitful buds has been left upon the vine to utilize all the sap pumped up by the roots. To remove these water-sprouts, therefore, while they are young is simply to shut off an outlet for the superabundant sap and thus to injure the vine by interfering with the water equilibrium, or to cause it to force out new water-sprouts in other places. Any vigorous vine will produce a certain number of water-sprouts, but they should not be looked upon as utterly useless and harmful because they produce no grapes. On the contrary, if not too numerous, they are of positive advantage to the vine, being so much increase to the feeding surface of green leaves. Water-sprouts should be removed completely during the winter pruning, and the production of too many the next year prevented by a more liberal allowance of bearing wood.

Topping, or cutting off the ends of shoots, is done by means of a sickle or long knife. At least two or three leaves should be left beyond the last bunch of grapes. The time at which the topping is done is very important. When the object is simply to prevent the breaking of the heavy, succulent canes of some varieties by the wind, or to facilitate cultivation, it must of course be done early, and is well replaced by early pinching. These objects are, however, better attained by appropriate methods of planting and training. Early topping is inadvisable, because it induces a vigorous growth of laterals which make too dense a shade, and it may even force the main eyes to sprout, and thus injure the wood for the next year. The legitimate function of topping is to direct the flow of food material in the vine first into the fruit, and second into the buds for the growth of the following year. If the topping is done while the vine is in active growth, this object is not attained; one growing tip is simply replaced by several. In this way, in rich, moist soils vines are often, by repeated toppings, kept in a continual state of production of new shoots, and as these new shoots consume more food than they produce, the crop suffers. Not only does the crop of the current year suffer, but still more the crop of the following year, for the vine devotes its energy to producing new shoots in the autumn instead of storing up

reserve food material for the next spring growth. If, on the other hand, the topping is done after all leaf growth is over for the season, the only effect is to deprive the vine of so much food-absorbing surface.

The topping, then, should be so timed that while a further lengthening of the main shoot is prevented no excessive sprouting of new laterals is produced. The exact time differs for locality, season, and variety, and must be left to the experience and judgment of the individual grower.

Removal of Leaves.—In order to allow the sun to penetrate to and aid the ripening of late grapes it is often advisable late in the season to lessen the leafy shade of the vine. This should be done by removing the leaves from the center of the vines, and not by cutting away the canes. In this way only those leaves are removed which are injurious, and as much leaf surface as possible is left to perform the autumn duty of laying up food material for the spring. The removal of leaves should not be excessive, and if considerable, should be gradual, otherwise there is danger of sunburn. It is best, first, to remove the leaves *from below* the fruit. This allows free circulation of the air and penetration of the sun's rays, which warm the soil and are reflected upon the fruit. This is generally sufficient, and in any case only the leaves in the center of the vine, and especially those which are beginning to turn yellow, should be removed.

Second Crop.—In parts of the San Joaquin Valley the Zinfandel gives very little first crop, and that of poor quality. In these vineyards, early topping, producing a large number of lateral shoots, is useful, as it increases the second crop, which is borne on laterals, and is in these locations superior for wine-making to the first.

Varieties.—In the list of varieties which follows, an attempt has been made to indicate the mode of pruning which is likely, in the light of our present knowledge, to give the best results for each variety. It should be understood, however, that it is to some extent tentative and provisional. Many of the varieties have proved successful in certain soils and locations when pruned in the way indicated, but others have never, so far as we know, been tested in the way proposed. As these latter, however, have proved more or less unsuccessful under the common methods of treatment, the method proposed is the one which seems most suitable to their habit and general character. It seems probable that the tendency to coulure of some varieties, such as the Muscat, Malbec, Merlot, Clairette, etc., can be combatted to a great extent by appropriate methods of pruning and training. Unevenness in ripening, and liability of Tokay, Zinfandel, etc., to sunburn, can doubtless be controlled by the same means.

Very few varieties succeed under strictly short pruning, that is, cutting back to one and two eyes, so that for most of the varieties in the first category the modification of short pruning, which gives fruit spurs of three or four eyes and wood spurs of one eye, is recommended.

Type I. Charbono, Cinsaut, Mataro, Carignane, Grenache, Petit and Alicante Bouschet, Aramon, Mourastel, Verdal, Ugni-blanc, Folle blanche, Burger, Zinfandel, Grüner Velteliner, Peverella, Zierfahndler (?), Rother Steinschiller (on poor soils), Slankamenka, Green Hungarian

(on poor soils), Blue Portuguese (on poor soils), Tinta Amarella, Moscatello fino, Pedro Jimenes, Palomino, Beba (?), Peruno, Mantuo, Mourisco branco, Malmsey, Mourisco preto, Feher Szagos, Muscat of Alexandria, Barbarossa.

Type II. St. Macaire, Beclan (longer or shorter according to richness of soil), Tenturier male, Mondeuse, Marsanne, Chasselas, Muscatel. Grosse Blaue, Sauvignon blanc, Sauvignon vert, Nebbiolo, Fresa, Aleatico.

Type III. Cabernet Sauvignon and Cabernet Franc (on poor soils and hillsides), Verdot, Tannat, Gamai Teinturier, Gros Mansenc, Pinots, Meunier, Gamais, Pinot blanc, Pinot Chardonay, Rulander, Affenthaler, Johannisberger, Franken Riesling (on hillsides), Kleinberger, Traminer, Walschriesling, Rothgipfler, Lagrain (? perhaps short), Marzemino, Blue Portuguese (on rich soils), Barbera, Moretto, Refosco, Tinta de Madeira, Tinta Cao, Verdelho, Boal, Sultanina (=Thompson's Seedless), Sultana.

Type IV. Green Hungarian, Rother Steinschiller (on rich soils), Neiretta, Mission, West's Prolific, Robin noir.

Type V. St. Macaire and Mondeuse (on rich bottom soils), Tinta Valdepeñas, Marsanne, Clairette blanche, Semillon, Sauvignon blanc (on rich soils), Muscadelle du Bordelais, Vernaccia bianca, Furmint, Bakator, Tadone, Gros Colman, Black Morocco (?), Cornichon (?), Emperor, Tokay (?), Almeria, Pizzutello, California black Malvoisie.

Type VI. Malbec, Petite Sirah and Serine, Cabernet Sauvignon and Cabernet Franc (on rich bottom soils), Merlot, Gros Mansenc (? on rich bottom soils), Chauché noir, Bastardo, Trousseau, Ploussard, Etraire de l'Adhui, Chauché gris, Franken Riesling (on rich soils).

Samples Received for Examination.

Article.	Sender.	Address.	County.
Grapevine	C. H. Wente	Livermore	Alameda.
Diseased Vine Leaves	R. L. Nougaret	Oakland	Alameda.
Pomace (2 samples)	Frank Swett	Martinez	Contra Costa.
Diseased Meat	L. Graham	Fresno	Fresno.
Peach Twigs	C. J. A. Peterson	Selma	Fresno.
Olive Twigs	Board of Horticulture	Hanford	Kings.
Prune Branches	R. V. Sharp	Hanford	Kings.
Diseased Violet Leaves	W. A. Pischet	Santa Monica	Los Angeles.
Diseased Pork	J. H. Oester	O'Neals	Madera.
Olive Branches	A. R. Gurr	Merced	Merced.
Chips of Locust Tree	T. L. Kirkendall	Natividad	Monterey.
White Wines (6)	P. R. Schmidt	Calistoga	Napa.
Vines	B. Bruck	St. Helena	Napa.
Olives	C. L. Williamson	Auburn	Placer.
Paris Green (2)	James Rutter	Florin	Sacramento.
Wines (9)	C. E. Bundschu	San Francisco	San Francisco.
Prunes (2)	Cal. Fruit Grower	San Francisco	San Francisco.
Wines (5)	W. S. Keyes	San Francisco	San Francisco.
Tannic Acid	W. S. Keyes	San Francisco	San Francisco.
Diseased Vines	E. & J. Bender	Morgan Hill	Santa Clara.
Wines (2)	E. E. Meyer	Wrights	Santa Clara.
Paris Green	L. A. Hilborn	Suisun	Solano.
Vine Roots	B. W. Paxton	Healdsburg	Sonoma.
Grape Canes	C. Nisson	Petaluma	Sonoma.
Olives	W. L. Hall	Nordhoff	Ventura.

8. MISCELLANEOUS.

THE EXTERMINATION OF WEEDS.

By E. W. Hilgard.

So much of the farmer's time and labor is spent in the repression of weeds that some general rules in regard to the principles upon which such work should be done to the best advantage, may fitly be given.

Annual Weeds, or those which mature their seed the first year, are on the whole the most easily gotten rid of, provided the fixed policy of *never allowing a single plant to go to seed* is rigorously adhered to. It is palpable that as a rule it is very much easier to destroy a young plant, than an old one with deep roots; and as the young plant is certain to grow old if let alone, there is no reason why it should be left on the ground longer than may be advisable to insure the sprouting of all the seeds likely to come up at one time, so as to take them all in one operation.

It is a common thing to hear farmers say that it is not worth while to plow or cultivate to destroy little seedlings; also, that in California the little "summer weeds" do no harm. As a matter of fact it is the little summer weeds that keep the ground re-seeded every season; the little wheels of bur clover, knotgrass, Napa thistle, pigweed, and alfileria that lie close to the ground in summer and seem too insignificant to worry about, are the most prolific in seed and are the cause of the multitude of plantlets that spring up immediately after the first rains. In no case is the adage that a stitch in time saves nine, more literally true than in regard to these insignificant summer weeds. But it is difficult to convince the average foreman that the greensward which is thus brought out and which he frequently cannot touch in time on account of wet weather or because the vines have not yet been pruned, results mainly from the neglect of a cultivation after the last rain, and some supplementary hoeing.

In consequence of the fact that all but the very smallest seeds can maintain their vitality for several years if buried at some depth, even annuals cannot always be exterminated by destroying the seedlings during a single season only. Especially in adobe soils that crack open in summer, such seeds as mustard and pigweed will maintain themselves intact in the depths of the soil, to vex the farmer by an unexpected reappearance when brought near the surface again by the plow.

Perennial Weeds, like morning-glory, wild heliotrope, seashore verbena, milkweed, Johnson grass, Bermuda and salt or alkali grass, etc., can be effectually extirpated by a simple process followed out faithfully for one season at least: *The tops or sprouts must be cut continuously as*

oon as they begin to show above the surface of the ground and before they have had time to strengthen the roots or rootstocks by putting out green leaves; thus exhausting the nourishment stored in the subterranean vegetation, in the vain efforts to reach the sunlight.

In cultivated ground this can best be done by means of a sharp "duck-foot" weed-cutter or cultivator, run two or three inches deep as often as may be necessary, and supplemented by the hoe where the cutter cannot reach, as in orchards and vineyards. It is essential that the tool be kept *well sharpened*, for otherwise it will drag and tear instead of cutting the stems, and the dragged stems will recover, while each piece torn off will make a new plant. This may have to be done once a week for some time; in some soils oftener, in others less often; *but not a single cutting must be omitted* on pain of losing most or all the advance previously made toward the exhaustion of the roots, which is sure to ensue from the failure of the sustenance derived from the air, if the plan is persistently pursued.

It is idle, however, to employ halfway means in this work. It must be consistently and faithfully carried out and is then sure to be effective. If it be objected that it is troublesome and costly, it should be remembered that in the end even the entire loss of one season's crop on the infested ground is much cheaper than the everlasting fight and short crops for years; or than the trenching and screening of the ground sometimes resorted to as a last remedy, and yet ineffective because every inch of the rootstocks of morning-glory, Johnson or Bermuda grass will root independently, and it is impossible to be sure of removing every such fragment from the land.

It is frequently proposed by sufferers from the above weeds that they might be poisoned by means of salt or other compounds put on the ground. This idea is based upon the fact that many plants refuse to grow on alkali land, and upon the historic threat of conquerors to "sow salt" on the lands of rebellious subjects to render them forever unproductive. But there is no record of this threat having ever been successfully carried out, doubtless because of the large amount of salt that would be required for the purpose (say not less than six tons per acre), and also because any such attempt would, outside of the arid region, be frustrated by the succeeding season's rains washing the salt into the country drainage. In the arid region we already have all the alkali land we want, and its reclamation is rather costly when common salt is in question. Moreover, weeds are much more hardy than our culture plants, or they would not be "weeds." At best the weed-poisoning process, therefore, cannot but be considerably more costly in its execution and after-effects than the simple remedy given above.

It should not be forgotten that according to our present knowledge, bur clover and other plants of the legume (pea or clover) family add greatly to the fertility of the land when plowed in. It may therefore be policy to allow the land to be stocked to a moderate extent with such useful weeds as bur clover, which grow in winter and can be turned under as a green-manure at the last plowing in spring.

LUPINS FOR GREEN-MANURING.*

By J. Burtt Davy.

INTRODUCTION.

GREEN-MANURE CROPS.

The Need for Green-Manure Plants.—The importance of returning to the soil of orchards and vineyards an amount of nitrogen at least equivalent to that removed by the fruit crop, and also the humus gradually burnt out during the dry season, in order to maintain fertility, has caused the Experiment Station at Berkeley to devote much attention to the testing of various leguminous plants—plants of the pea and clover family—recommended for this purpose in other parts of the world. While it is comparatively easy to find plants that will answer this purpose when or where summer growth can be allowed, as in the case of field crops, the selection of plants that will grow in winter so as to permit of being turned under before the summer's drought renders such growth too wasteful of moisture, is a matter of no little difficulty. The present paper is designed to give the most promising results thus far obtained, in order to promote large-scale experiments by farmers during the present and coming seasons.

Plants other than those of the leguminous order (clovers, peas, beans, lupins, etc.) are not recommended for green-manuring, for the reason that they supply to the soil only the humus, besides what substances they have taken from it during their growth; while yet, a leguminous crop costs no more than any other. It is true that in the case of all tap-rooted plants the surface soil is enriched by what was taken from the subsoil. But as in the arid region the surface soil is largely of less importance than the subsoil, on account of the deep-rooting and feeding characteristic of plants in arid climates, the advantage thus secured is greatly reduced; as is also that of the crop roots being afforded an opportunity of deep-rooting by following the course of the tap-roots of the preceding crops. Moreover, nitrogen being the most expensive of elements supplied in manures, the advantage of securing it from the atmosphere without additional cost is obvious.

The legumes combine all the points required of a green-manure plant—nitrogen-absorption from the air, deep-rooting, and, at the proper stage of growth, that succulence which is conducive to quick decay; thus rendering the crop-ingredients available at the earliest moment. Nevertheless, the plowing-in of other green crops or weeds, when convenient, should not be neglected.

It should be stated that the absorption of nitrogen from the air is conditioned upon the formation of excrescences or tubercles upon the roots; these being formed by the bacilli possessing that valuable faculty. When the soil is abundantly supplied with available nitrogen-compounds, tubercles may fail to form; and such failure may also result from the absence of the proper bacilli, rendering necessary the "inoculation of the land."

*Reprint of Bulletin 124.

Peculiar Conditions Require Peculiar Plants.—The peculiarities of the climatic and agronomic conditions of arid regions make it largely impracticable to utilize the crops employed in humid regions. Our choice is ordinarily restricted to annual plants which make a good winter growth and can be plowed-under in spring (usually in March), so as to avoid the waste of moisture from summer growth; they must be adapted to calcareous soils; and must have stems not so woody as to resist fairly rapid decomposition.

It has been suggested that many of our native California species would prove better adapted to these conditions than introduced plants; but none of the numerous species so far tested for this purpose have given entirely satisfactory results; they develop too late in the season, and are not always hardy against frosts.

Among the various leguminous crops so far experimented with at Berkeley, Bur Clover (*Medicago denticulata*), Square-pod Pea (*Lotus Tetragonolobus*), and Snail Clover (*Medicago turbinata*), have given the most promising results; but none of them yield as heavy a crop as could be desired, and the two latter have not been found suited to all our climatic conditions.

For further information on the subject of green-manuring, the reader is referred to the Report of this Station for the year 1894–5 under the title of "Supply of Soil Nitrogen," pp. 32 to 35, and "Crops for Green-Manuring," pp. 118 to 123.

The Station has sent for a sufficient supply of seeds of the several kinds of lupins herein mentioned, for the distribution of small trial packets early in autumn. But as the success of some of the varieties mentioned for green-manure purposes is already definitely ascertained, it is hoped that the facts here given may induce some enterprising seedsmen, or private parties, to make larger importations from France and Germany for large-scale trials, which cannot fail at least to pay expenses, if they do not prove highly remunerative.

E. W. HILGARD.

LUPINS FOR GREEN-MANURING.

Discovery of the Adaptability of Certain Lupins.—In cultivating, in the Botanic Garden, a collection of Mediterranean-region lupins for comparative botanical study, it was found that the spring-sown plants did not have time to reach maturity before the hot, rainless season dried them up. It was therefore determined to try fall-sowing, with a view to catching all the moisture available, thus inducing winter growth and deep-rooting. As a result of this experiment it was found that whereas the spring-sown plots were a complete failure, the fall-sown, in accordance with Italian experience dating back to the Romans, produced heavy crops, and were so promising that it was determined to test the species on a more extensive scale, with a view to the adoption of the best of them for green-manure crops. The results of these tests are outlined in the following pages.

Though the most important use of lupins lies in their adaptability for green-manuring, they are also grown extensively in Europe for cattle-forage and human food, and as ornamental plants. (See p. 223.)

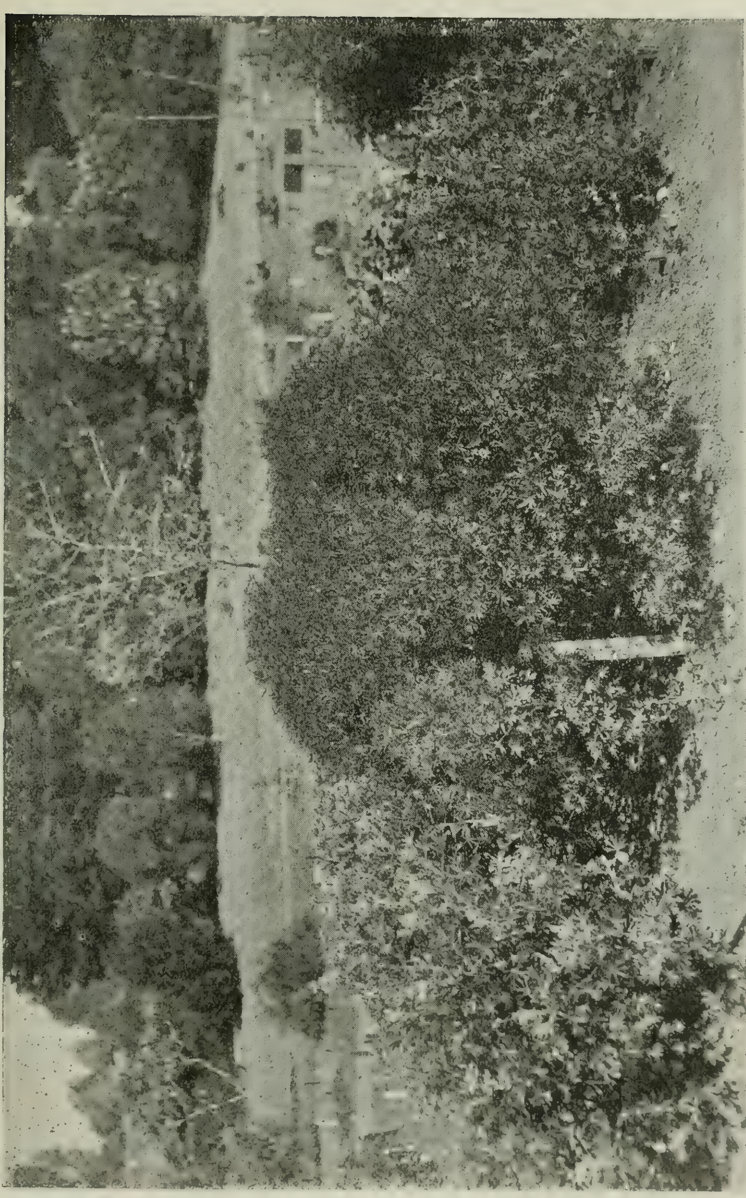


PLATE 19. LUPINS IN THE BOTANIC GARDEN, BERKELEY, 1898.

1. Pink Lupin. 2. Small Blue Lupin. 3. Yellow Lupin.

Thirteen species or varieties of lupin are more or less extensively cultivated as agricultural crops in various parts of Europe and north Africa; of these, eleven are natives of Europe, one of Chile and Peru, and the other of North America. Seven of the most important species have been the subject of investigation at Berkeley in the last four years, but some of them only during the present season.

In addition, ten annual native Californian species have been under cultivation in the Botanic Garden at Berkeley for seven years; only two of these, however, *Lupinus affinis* and *L. micranthus*, promise to be of any agricultural value.

1 2

PLATE 20. LARGE BLUE LUPIN.
1. At time of first flowering. 2. At time of second flowering.

DETAILS REGARDING THE SEVERAL SPECIES OF LUPINS.

1. LUPINUS PILOSUS, Linn.—This species is an annual and a native of the eastern Mediterranean region (Grecian Archipelago, Syria, Palestine, etc.). It is readily distinguished from all other species known to us by its large, flattened, brown, bean-like seeds, nearly half an inch broad, of which the outer seed-coat is roughened with minute projections; the leaves are large and velvety, with broad leaflets; the flowers bracted.

The typical wild form does not appear to be in cultivation, but it has given rise to two cultural varieties, *L. pilosus cæruleus*, Hort., and *L. pilosus roseus*, Hort., both of which seem, from all available information, to be in cultivation in Italy and France, but probably only to a limited extent, as we find no mention of them in agricultural literature.

2. Large Blue Lupin (*Lupinus pilosus cæruleus*, Hort.), Plate 20.—Annual, flowers large, dark blue, with a white line down the center of the standard, which in age changes to dark purple. The seeds are heavy, there being only 760 to a pound of Berkeley-grown seed.

Experiments at Berkeley.—For heavy, calcareous soils, this is undoubtedly the best of the species tested; it has shown no sign of root-rot, although species adjacent on all sides were affected; it is not injured by frosts at Berkeley, is more succulent than the varieties of *L. angustifolius*, produces more and larger foliage, and covers the ground better, branching more freely from the base. The size and heaviness of the seed would seem to be a disadvantage, but this is outweighed by the fact that owing to its branching habit, it requires more room in the rows, and the same weight of seed per acre will produce one-third more manure than in the case of the Small White Lupin; so that the former species is in the end the cheaper of the two. It produces a larger number of well-developed root-tubercles even under the very adverse conditions which caused an absence of tubercles in all other species except No. 3 (the Pink Lupin).

Before branching it produces, very early in the season, a terminal flower-spike, and in this state is quite succulent. When the first pods form, the whole plant branches freely, and becomes somewhat woody; these branches flower much later than the main stem. Owing to this peculiarity it may be advisable to plow-in the green-manure at the beginning of February, or, if conditions of soil and climate make this impracticable, then to sow from two to four weeks later in order to bring the period of first flowering nearer to plowing time, the plants being in the best condition for quick decay when the first flowers appear.

Experiments at Pomona.—Mr. Mills, foreman of the Southern California substation near Pomona, reports that at first this promised to be the best species under observation, but that the larvæ of some insect attacked and destroyed a large number of plants and nearly killed the rest. The latter finally sent out branches which came into bloom when the plants were about eighteen inches high; they were again attacked by the same insect, which destroyed nearly all the flower-heads; the weight of seed finally produced was little more than the amount originally sown. This species was also damaged by the frost of March 23, 1898, at 7 A. M., when for half an hour the mercury stood at 27° F. At Berkeley it was not affected by the frost of February 4, 1899, when the thermometer registered 29.9° F., and when several other plants including the native *Lupinus affinis*, were injured.

3. Pink Lupin (*Lupinus pilosus roseus*, Hort.), Plate 21.—An annual, closely resembling the preceding variety in general habit, size, pubescence, etc.; but the color of the flowers is pale pink, with a white line

down the center which in age changes to magenta. The seeds are almost as heavy, there being 864 to a pound of Berkeley-grown seed.

Experiments at Berkeley.—This variety has the same habit of growth as the preceding and, like it, is not affected by frost or root-rot; but the tests this year indicate that in new soil, not inoculated with the lupin bacteria (see p. 219), it will not always produce tubercles as readily as the Large Blue Lupin.

1 2 3

PLATE 21. PINK LUPINS.

1. At time of first flowering. 2. Showing tubercles.
3. At time of second flowering.

4. YELLOW LUPIN (*Lupinus luteus sativus*, Hort.)—*Lupinus luteus* of various authors; *L. odoratus*, Hort., Fragrant or Scented Lupin. FRENCH: Lupin jaune, Lupin odorant. GERMAN: Gelbe lupine.

Annual, low-growing and much branched from the base; stem succulent; flowers rich yellow, very fragrant.

The wild plant of which this is a cultivated variety is a native of the Mediterranean Region.

Uses.—The Yellow Lupin has been grown since 1840 as a forage plant in parts of Germany (Saxony, Silesia, Pomerania, Bohemia, Moravia,

and Brandenburg) and of France (Boulogne, Manche, and Bourbonnais). It is also said to be grown in some parts of England, and in Norway as far north as 70° latitude.

It is the least bitter of the cultivated lupins, but animals are said not to care for it in a green state, and it is usually made into hay. At present, however, it is extensively cultivated as a green-manure, to improve the poor sandy soils found in parts of Prussia and of France; for this purpose it is considered the best of all the species tried there, and will thrive even on drift-sands of the sea coast. Langethal observes that what the Sainfoin is for the poorest limestone or marly soil, the Yellow Lupin is for sandy land. As a green-manure it is considered superior to the Small Blue Lupin, because the roots penetrate the soil to a much greater depth, and because rye is found to succeed much better after the Yellow than after the Small Blue Lupin; wherever possible, therefore, the former is grown in preference to the latter; as far as Europe is concerned, it is more extensively grown than any other species. Kette observes that this species shows an advantage over the others in never being choked by weeds if the soil is at all suitable.

Soils.—Heuzé states that it will not succeed in impermeable or calcareous soils, but that it grows well in deep sandy, and light and ferruginous soils, and forest lands which have lost their acid character; it is not grown on clay soils. Werner notes that it does not do as well as the Small Blue Lupin on gravelly or marly soils. Our own observations show that of all the species tried at Berkeley, this is the most difficult to grow in heavy, strongly calcareous adobe soils, partly owing, doubtless, to their impervious character; the seeds germinate readily, and the plant makes a good stand when the soil has been dressed with stable manure.

Cultivation.—In France it is customary to sow from 70 to 110 pounds of Yellow Lupin seed to the acre. In Hanover the following rotation is often practiced: With the last hoeing of the potato crop, from the end of April to the middle of May, lupin seeds are dropped between the rows of potatoes. In the fall the potatoes are harvested and the lupins plowed-under. Rye or winter wheat is then sown, sometimes immediately after plowing, without any bad results (Kette); though oftener fourteen days are allowed to intervene. After the grain harvest, in the following August, the land is again plowed and lupins are sown for a winter crop, which is plowed-under in the spring and is followed by a crop of oats. When grown for seed the Yellow Lupin is harvested at the end of August.

Experiments at Berkeley.—For three successive seasons this species has proved a failure in the strongly calcareous adobe soil at Berkeley, except when treated with stable manure; in which case, however, though it made a fine growth of succulent matter, scarcely any tubercles were produced, showing that the nitrogen was derived from the soil. There is little doubt that if sown early enough this species would prove very beneficial on our light, non-calcareous soils, and it should be tried in the granitic and red soils of the Sierra Nevada foothills, and the sandy soils on the plains at the foot of the Tehachapi and the Sierra Madre ranges. It has not been affected by frost or root-rot. It is much later in time of flowering than either of the varieties of *L. pilosus* or of *L.*

angustifolius, not coming into bloom till the second week of March. The table on p. 222 shows the yield of green material to be very poor; but this is due to the fact that in this instance few seeds germinated and but very few plants came to maturity, doubtless owing to the soil conditions. In manured soil, where all the seeds germinated and the plants attained good height, the weight of green material was much greater.

5. SUCCULENT LUPIN (*Lupinus affinis*, Agardh.).—A rather low (2 to 2½ feet high), much branched, succulent annual; flowers purplish, seeds medium-size. It is indigenous to California, growing luxuriantly on sloping adobe or clay banks, from Marin County southward to San Diego.

Experiments at Berkeley.—We are not aware that this species has been tried, either for forage or for green-manure, except in California, and with us it has proved unreliable in germination, slow in coming to maturity, and less resistant to frost than the foreign species. Several plants were cut to the ground in the cold snap of February 4, 1899 (29.9° Fahr. at the University observatory, and probably still lower on the ground), when the European species were not affected.

Southern Coast Range Substation.—A letter from the foreman of the substation informs us that *Lupinus affinis* (as determined by the Department of Botany) is of common and heavy growth in the Willows Creek District, twelve miles west of Paso Robles. The plants were found to have an average height of 3 or 4 feet, and twenty of them weighed twenty-four pounds.

Lupinus affinis ranks next to *L. luteus* in succulence, but does not decompose as thoroughly nor as rapidly. Although its germination is unreliable, under cultivation it shows a tendency to improve in this respect. It produces a heavy crop of seeds. Under steady cultivation this species is likely to prove a valuable plant for green-manure in *frostless* regions; it produces an abundance of tubercles both in new soil and in soil which has been manured. On this account, and because of its heavy yield per acre and great succulence, it is worthy of more attention.

6. NARROW-LEAVED LUPIN (*Lupinus angustifolius*, Linn.).—In modern Greece called "Agri lupouni," and in Egypt "Termis el Sjaeitan" (Satan's Lupin), possibly on account of its habit of springing up as a weed among crops of cultivated lupins, like the tares of the Scripture parable.

Annual, branching from the base, about 1½ feet high; leaflets narrow, flowers small, pale blue; seeds ovoid, smooth, mottled with gray and white. Not in full flower till the middle of April.

This is the typical wild form, a native of the Mediterranean region of south Europe and north Africa, where it occurs as a weed in grain-fields. We first find mention of it about 306 B. C. It is supposed to be the plant spoken of by Dioscorides as "Thermos agrios," and the "Lupinoum agrestum" of the Romans. It does not appear to be now cultivated for agricultural purposes, but from it have been obtained the valuable varieties called respectively *cæruleus* and *diploleuca*, the Small Blue and the Small White Lupin.

Naudin says that sheep are pastured on it in places where it grows wild. It is said to prefer sandy, poor soils, and appears to dislike excess of lime.

Experiments at Berkeley.—During three successive seasons we have found *Lupinus angustifolius* much less reliable than the two succeeding varieties; it does not germinate well in our calcareous soil, makes an unequal stand, and is shorter and slower of growth. It branches much more freely from the base than its varieties, but like them it lacks the succulence of some other species. It is liable to infection with root-rot. The stems do not decompose readily; after being plowed-under and remaining a month (from March 18 to April 22, 1899), they were still long and fibrous. This species produces but few tubercles, and is late in flowering.

7. Small Blue Lupin (*Lupinus angustifolius cæruleus*, Körn), Plates 22 and 23.—German: Blaue Lupine; French: Lupin bleu, Lupin à fleurs bleus, Petit lupin bleu.

Closely resembling *L. angustifolius*, of which it is only a cultural variety, but taller (3 feet), not branched from the base, and with flowers of a brighter blue. It is in full flower early in March. A somewhat woody-stemmed variety. As to when and where it originated we appear to have no record; it is probably the plant referred to by Tournefort, in 1700, as "L. angustifolius cæruleus elatior." It was first cultivated in Germany for green-manure in 1830.

Uses.—It is now grown extensively for green-manure, both in Germany and France, especially about Bordeaux (Kette). According to Cornevin it was more largely grown in France in former times than at present, being used for feeding sheep; it has been neglected for this purpose of late years, on account of its poisonous qualities (see p. 223). Langethal considers that it is of small value as green forage, on account of the hardness of its stems, but that the large amount of seeds produced, which are fed to stock, renders it a valuable crop.

Soils.—Werner states that on gravelly and marly soil the Small Blue Lupin gives better results than the Yellow Lupin. It is fairly tolerant of limy soils in California, but less so than the varieties of *L. pilosus.* Langethal notes that it grows very well on a stiff and even a clayey soil which is sufficiently broken up by repeated plowing; in this respect it is superior to the Yellow Lupin. Werner states that the seeds of this species lose the power of germination more rapidly than those of *L. luteus*, but they are easier to collect, not falling out of the pods as readily as they do in that species.

Experiments at Berkeley.—At first this gave promise of being the species best adapted for green-manuring in middle California; it germinates readily, and makes an excellent stand in our calcareous, blackish adobe soil, is not affected by frost, and is a rapid and robust grower. It does not, however, branch well from the base, and fails to rot quickly and thoroughly after plowing-under. During the present season it has been badly affected by a root-rot, which has in some rows destroyed from 50 to 75 per cent of the plants, especially in the late-sown plots. The effect of early sowing on the yield of green material is admirably shown on plate 19, the large plants having been sown at the end of Sep-

tember, and the smallest ones (photographed at the same time and on the same plate) were sown November 17th.

Chino Valley.—Mr. Mills reports for 1897–8 that at the Southern California substation it came up in good season after planting, and promised

PLATE 22. SMALL BLUE LUPIN, GROWN AT BERKELEY.

to make a good growth; it was badly damaged, however, first by hares, then by the heavy frosts of March 23d, and finally by root-rot. This species early produces a very long tap-root in the Pomona soil, as is well

shown on the plate. For the season of 1898–9 Mr. Mills reports that although the plants were frozen stiff, clear to the ground, by the heavy frost of February 6th, they showed no bad effects after thawing out. He considers that if the ravages of root-rot can be successfully combatted by

1 2 3 4

PLATE 23. SMALL BLUE LUPIN, GROWN AT POMONA.

1. Sown November 17. 2. Sown September 28.
3. Thirty-day seedling at Pomona. 4. Thirty-day seedling of L. pilosus at Pomona.

treating the seed, or by any other means, this species will be preëminently the best for the uncertain seasons of Southern California.

Sierra Foothills.—The Small Blue Lupin appears to be absolutely worthless on the granitic and red soils of the Sierra foothills at Jackson,

Amador County. With a rainfall of twenty-six inches, plants raised from seed sown October 24th and 25th, 1898, had only attained a maximum height of eight inches by April 20, 1899, at which time they were setting seed. Much the same result is reported from Anaheim, Orange County; but in both cases it may have resulted from the late sowing.

8. SMALL WHITE LUPIN (*Lupinus angustifolius diploleuca*, Körn). GERMAN: Ostpreussische weisse lupine. Scarcely differs from the var. *cæruleus*, except in having white flowers and white seeds.

Kette states that since 1881 this plant has been increasingly grown in Germany for forage, as a substitute for the Small Blue Lupin, because the seed is less injurious to cattle than that of the latter variety.

In California there is no difference noticeable as to the growth of the plant; it appears to be equally susceptible to root-rot.

Southern California.—Mr. Mills reports as follows for 1897–8: "Sown October 19th, sprouted November 1st, it came up in good season after planting, and promised to make a growth that surpassed that of any other variety; but the hares made a dead set on it, and before we could get the batch of invaders killed off they had cut off the central stem of all the plants, and they lost considerable valuable time. They then sent out lateral shoots, but again lost considerable time when they would otherwise have made their best growth, for the heavy frost on March 23d killed the greater part of the flower-spikes. It finally matured seed when about two feet high. It would undoubtedly be the best of the species tested, if given a fair start and with normal conditions of weather."

9. LARGE WHITE LUPIN (*Lupinus albus*, Linn.)—*Lupinus albus vulgaris*, Alefeld. GERMAN: Weisse Dünglupine, Gewöhnliche weisse lupine. FRENCH: Lupin blanc, Pois lupin, Pois de loup, or Fève de loup. ITALIAN: Lupino; and PORTUGUESE: Tramoso.

Not unlike *Lupinus pilosus* in habit, but the flowers are white, without bracts; upper lip of calyx entire; seeds smooth, white.

The Large White Lupin is apparently a native of Italy and Sicily; it also occurs in a wild state, but perhaps naturalized, along the eastern coast of the Mediterranean and as far east as the Caucasus.

History.—It appears to have been grown in Egypt at a very remote period of antiquity. It is considered to be identical with the "lupinus" of Cato, Varro, Virgil, Columella, Pliny, and Palladius, and the "loupinoum" of Dioscorides. The Greeks and Romans cultivated it as early as 396 B.C. for green-manure, as well as for the seeds. The occurrence in Spain of four common names for this plant, differing according to the province, indicates, according to De Candolle, its very early cultivation in that country. In Germany it was first cultivated in the Rhine provinces, in the sixteenth century, for green-manure only; in Austria in the seventeenth century, and in Saxony in the eighteenth century. In Italy it was being very largely grown in the eighteenth century.

In recent times the Large White Lupin has been cultivated in Egypt, Greece, Italy, Spain, Portugal, southern France, and Germany. It is not much grown in northern France, being subject to injury from frost.

In southern France it can endure a temperature as low as 10° C. (14° F.), if sown sufficiently early in the fall; in the north of Europe, on account of frost, it is not sown before the middle of April, does not flower before the end of August, and fails to ripen seed (Kette).

Uses.—In some parts of Italy it is used as a mulch around the olive trees. The French grow it to improve the quality of their poorest lands. In Germany it has been considered a good green-manure, as it yields a large quantity of foliage; but latterly it appears to have fallen into disuse, and to have been superseded by the Small White Lupin.

Naudin states that in Spain and Portugal the Large White Lupin is considered a good and nourishing forage plant; Vesque considers, however, that its foliage is too bitter to serve for this purpose. De Candolle states that the seed is good fodder for cattle, but in Germany it has been found that cattle dislike both leaves and seeds. In Portugal, according to von Mueller, it is highly esteemed, under the name of Tramoso, as a remedy against pernicious and obstinate weeds, especially Sorrel (*Rumex Acetosella*, Linn.), on account of its close and early growth.

The seeds, boiled to deprive them of their poisonous properties, were sold for human food in the streets of ancient Rome, and were also used for food by the ancient Egyptians and Greeks. They are still so used by the inhabitants of Andalusia, Corsica, Piedmont, Spain, and Portugal, according to Cornevin.

Soils.—In southern Europe the Large White Lupin is grown almost exclusively on sandy and siliceous soils. In Germany, von Wulffen cultivated it only on a warm sandy soil, and found that marling did not perceptibly increase the yield. Dr. Pabst found that it would make a growth, though only small, on a loamy, sandy soil, which contained much lime and magnesia, and on which the Yellow and Small Blue Lupins always failed; so that, though susceptible to calcic carbonate, it seems to be less so than those species (Werner).

10. EGYPTIAN LUPIN (*Lupinus Termis*, Forsk.)—*L. albus Termis*, Alefeld; *L. prolifer*, Desrouss.; Sicilian, Roman, or Neapolitan Lupin; GERMAN: Weisse Futter-Lupine, Ægyptische, or Sicilianische Lupine, Römische Lupine, Sprossende Lupine; EGYPTIAN: Tharmos; ARABIC: Termis or Termus.

Described as very closely resembling *L. albus*, but taller and branching from the ground; keel blue, darker at the tips; seeds larger, only 305 to a pound of German-grown seed; flowers later. In Germany, it does not ripen seed till October.

It is found wild on some of the islands of the Mediterranean, was cultivated by the ancient Egyptians, and is still cultivated in Egypt, Greece (Boissier), Crete (De Candolle), and Germany (Kette).

Uses.—In Germany it is said to yield a large amount of green forage, but the stem becomes woody toward autumn. In Egypt the seeds are eaten, after steeping to remove the bitterness, and they are even exported to India (though not cultivated there) and sold in the bazaars under the name of *tourmus* (Royal). We have no record of its having been used for green-manuring; it may prove too woody for this purpose.

Soils.—Kette observes that the Egyptian Lupin is less susceptible to lime than *L. luteus;* he considers that the soil best adapted to it is a sandy loam, or a loamy sand; a small quantity of lime carbonate in

the soil seems to have a beneficial influence in shortening the period of growth. He observes that in uncultivated, sandy soil, where the Yellow Lupin attained a height of 2 feet, the Egyptian Lupin was only 6 inches high; while in cultivated soil it attained a height of 4 feet, and on manured loamy soil a height of 7 feet. Manure is said to cause a greater increase in yield in the case of the Egyptian Lupin than in the case of the Small Blue or the Yellow Lupin.

11. Cruickshanks' Lupin (*Lupinus Cruickshanksii*, Hook).—*L. mutabilis*, Lindley, not of Sweet.

A tall, woody annual, native of Chile and Peru, and long cultivated as an ornamental plant; the flowers are very handsome, the standard being white, streaked with purple on the margins and with a yellow spot in the center; in age the white standard changes to purple. In recent years it has been grown for forage in Germany, and it is said that cattle prefer it to the Yellow Lupin, especially if mixed with clover. German writers state that it needs a good soil if side-shoots are to be formed, but that if the soil be too rich it will not develop much seed.

At Berkeley all but two of the seeds germinated readily in the season of 1897–8, but were killed by a hot northeast wind just after the cotyledons appeared above ground. The two more tardy seedlings survived, however, and one produced seed from which the present crop has been raised. This year (1898–9) it has made a good growth; but has not produced tubercles, as it was sown in manured soil. Doubtless it will produce tubercles in unmanured soil, but it does not appear promising for green-manure, as the stems are woody. Our plants made very few side-shoots below, though the soil was rich, but branched well from above. Another season's test is necessary before its value can be ascertained.

12. Tricolored Lupin (*Lupinus tricolor*, Hort.), of south European gardens, has been tried at Berkeley, but without very satisfactory results so far. It is less tall and more branched below than the preceding species. The flowers are at first very light-colored, the standard being pale lavender and the wings pure white; after a few days the color of the standard gradually deepens to rich purple, and that of the wings to a lighter tint of the same.

13. Perennial Lupin (*Lupinus perennis*, Linn.).—Perennial; rootstocks creeping; stem branching very freely, covering the ground; flowers pale bluish-purple; seeds very small. Flowering period, May and June.

A native of the eastern United States, from Canada to Florida. Cultivated in Germany as a forage plant, and found less objectionable to cattle than the Yellow Lupin. It requires a good soil, retentive of moisture and clayey, because the creeping rootstocks draw their moisture from the surface, not reaching down to the subsoil; on this account Langethal considers that it may prove a valuable substitute for other leguminous crops in places where the surface soil is good but the subsoil poor, as in some of the hilly parts of middle Germany. It begins to grow early in the spring, and according to Langethal "will be 4 inches high by the time the apples are in bloom." Several crops can be obtained in a season, the first of which is ready early in June.

We do not find any record of its having been grown for green-manure; perhaps the creeping rootstocks make it unsuited for this purpose, as plants with this habit are usually plowed-under with difficulty, and pieces of the root continue to grow long after the time when the orchard or vineyard should be clear of weeds to prevent undue loss of moisture by their transpiration.

14. Hairy Lupin (*Lupinus hirsutus*, Linn.), *L. digitatus*, Forsk.—Annual; reddish-hairy; flowers blue; seeds somewhat flattened, grayish-brown, smooth.

Native of the northern shores of the Mediterranean, from Spain to Asia Minor. Cultivated extensively in Germany as an ornamental plant, it has also been tried as forage, and it is said that the cattle prefer both the green parts and the seeds to either the Small Blue or the Yellow Lupin. It has a disadvantage in that it does not flower till July (in Germany), and the seeds ripen late. The pods open too easily, making it difficult to collect the seed. It requires a good soil, and apparently will not thrive on the poor sandy soils on which the Yellow Lupin does so well.

Cultivated Species of Less Importance.—The Greek Lupin, *Lupinus Græcus*, Boiss., and the Netted-seeded Lupin, *L. reticulatus*, Desv. (*L. linifolius*), Roth., are also mentioned as being cultivated to a limited extent in portions of southeastern Europe, but we have no more definite information about them, except that the latter is not considered to possess any advantages over the Small Blue Lupin.

California Species Which Have Proved Unsatisfactory.—The following annual species have also been tried at Berkeley, but without success; they are all natives of California: *L. nanus*, Dougl.; *L. polycarpus*, Greene; *L. pachylobus*, Greene; *L. leptophyllus*, Benth.; *L. truncatus*, Nutt.; *L. microcarpus*, Sims; *L. densiflorus*, Benth.; *L. luteolus*, Kellogg.

Bitter Melilot (*Melilotus indica*, All.).—Though not by any means one of the lupins, yet on account of the importance of the subject of green-manuring at the present time, it has seemed best to take this opportunity of bringing the plant to the notice of agriculturists. Prof. A. J. McClatchie, of the University of Arizona Experiment Station, at Tucson, writes under date of April 27th, to the effect that in Arizona this plant is found to be the most successful green-manure crop that can be raised in their orchards. He continues: "The conditions are somewhat different with us than with you. Ordinarily we have plenty of irrigating water to grow anything we choose, until as late as April at least. Before that time the Melilotus makes a fine growth. We began plowing ours under about the first of April, the yield being 15 to 16 tons of green matter per acre, or 2½ to 3 tons of dry matter. Nothing else that we have tried will approach this in yield during the winter."

Reference to Table I (p. 220) shows that this yield is less than that of either the Pink or the Large Blue Lupin, and only just above that of the Succulent Lupin. At the same time the leaves of the Bitter Melilot are small and sparse, and the stalk is very woody; by far the largest part of the weight, therefore, is probably fibrous matter, unfitted for rapid decomposition, and of a nature to keep the soil perhaps too loose and

dry; both disadvantageous features. On the other hand, the hold which this plant has acquired upon California as a weed, the readiness with which it can be obtained and with which it will grow, the small size of its seeds, and the fact that it will *flourish and develop a fine mass of tubercles in alkali soils*, are points which make it worthy of further consideration. As in California it makes but little growth in winter, it could not replace the lupins for orchards and vineyards.

LUPINS FOR CALIFORNIA.

Species Recommended for Green-Manuring in California.—For heavy, strongly calcareous soils in middle California, such as the adobe lands, the Pink Lupin (*L. pilosus roseus*) and the Large Blue Lupin (*L. pilosus cæruleus*) are much the best of the various species tried at Berkeley. Though the seeds of these two species are few to a pod, large and heavy, and are therefore more expensive than those of any of the other species tried, an equal weight of seed will produce a larger amount of green material than in the case of the others (compare the Small White Lupin and the Large Blue Lupin in the table on page 220, where the weight of seed sown is the same, while the yield of the latter species is one half as much again). For the Chino Valley, Mr. Mills considers the Small Blue Lupin (*L. angustifolius cæruleus*) to be preëminently the best species, if the ravages of root-rot can be successfully checked.

For light, non-calcareous soils, the Yellow Lupin (*L. luteus sativus*) would undoubtedly be the most satisfactory, as it is so much less woody than any of the other species, and rots so much more quickly and thoroughly.

In a communication to the Landwirtschaftliche Presse of Berlin, written last summer, Professor Hilgard points out that where lupins will suffer from the presence of 0.46 per cent of calcium carbonate in sandy soils, as shown by Heinrich, they will tolerate twice as much in heavy clay soils.

Cultivation.—The success or failure of European lupins depends almost entirely upon sowing sufficiently early to catch the first rains, and at a time when the soil is yet warm enough to stimulate germination and prevent the rotting of the seed. If sown the last of September the Pink and Large Blue Lupins are ready to plow-under by the first of February, and the Yellow by the middle of March.

In Germany, where a crop of rye usually succeeds lupin, it has been customary to allow about fourteen days to elapse between plowing-in the lupin, and sowing the new crop, in order to allow the former to rot. Von Wulffen finds, however, that this is not necessary, and in France it is customary to sow immediately after plowing. Von Wulffen states that the green crop can be plowed-under either just before, during, or after flowering.

Lupins as well as other leguminous plants do not, as a rule, make tubercles in soil freshly manured with stable manure; the manure is injurious to the tubercle-forming bacteria. This does not prevent the lupins from making a good growth, however; indeed, they will often become very rank in manured soil, but the manure tends to check the formation of seed. We can readily see, therefore, that it is a needless expense to manure land for lupins, or to sow lupins on land already

manured, as the *presence of stable manure prevents the accomplishment of the chief end for which they are sown*, viz: the collection of nitrogen from the air by means of the bacteria on the roots.

Soil-Inoculation.—Where lupins do not grow wild, or have not previously been cultivated, it is sometimes necessary to inoculate the soil, in order to secure a satisfactory growth. By inoculation we mean in this case, the transfer of small quantities of soil in which lupins have been grown, to the plot in which it is wished to cultivate them. The necessity for this inoculation arises from the circumstance that the bacteria peculiar to lupins do not make tubercles on plants of any other leguminous genus, and therefore are not found in soils in which lupins have not grown.

For successful inoculation, Professor Hilgard recommends the use of lupin soil taken from the first six inches, in the proportion of about a half ton to the acre. It should be spread lightly over the surface, immediately after receipt, and then be harrowed or cultivated in without delay, to prevent drying-out, which would destroy the life of the bacteria.

Rotting.—On March 18th of this year a portion of the plots under observation at Berkeley was turned under to determine the relative rotting capacity of the different species. On April 22d the rows were opened, with the following results, numbered according to degrees of decomposition:

1. Yellow Lupin, thoroughly rotted.	
2. Succulent Lupin, 3. Small White Lupin,	A considerable amount of fibrous matter left, but less than in any of the succeeding species.
4. Pink Lupin, 5. Large Blue Lupin,	Not so good as 2 and 3, but better than Nos. 6 and 7.
6. Small Blue Lupin, 7. Narrow-leaved Lupin,	Foliage well rotted, but stems still very fibrous.

Method of Sowing.—Mr. Mills reports from Pomona: "The drill system seems to be the only practical method of putting lupin seed in the ground where irrigation is contemplated. By using a beet drill the seed can be planted with little expense, fifteen or twenty acres being an average day's work in an orchard. The cultivator used with a beet outfit can be used both for preparing the ground for irrigation, and for cultivation afterward. The regular duckfoot attachment that goes with the machine, if bent slightly backward, will make an excellent furrower. By mixing corn, cracked to prevent germination, with the lupin seed, the latter can be distributed along the rows at any distance desired. The lupin seed being much heavier than cracked corn, a mixture of half and half by weight, would require a comparatively small outlay for corn, to make the seed go over two or three times the area that it would if planted alone." Mr. Mills recommends light sowing, both for a green crop and for seed, as close planting encourages the spread of disease and prevents the "setting" of seed in all the pods, which is not counterbalanced by the increase in number of plants.

Use of Lupin Seeds for Human Food.—The seeds of many—perhaps all—species of lupin contain a bitter alkaloid known as *lupinin*, which is very poisonous to human beings. This bitter principle can be removed, however, by boiling, or by maceration in salt water or soda

TABLE I. COMPARATIVE TABLE OF CULTURES OF VARIOUS LUPINS AT BERKELEY.

Seeds sown in plot 8x5½ feet ($\frac{1}{990}$th part of an acre) September 28, 1898.

	Large Blue.	Pink.	Yellow.	Succulent.	Narrow-Leaved.	Small* Blue.	Small White.
Number of seeds to one pound	760	864	----	----	----	2,944	2,528
Amount sown per plot	1½ oz.	2½ oz.	½ oz.	½ oz.	½ oz.	1 lb, 1½ oz.	1½ oz.
Equivalent of seed in pounds per acre	lbs. oz. 92, 13	lbs. oz. 154, 11	lbs. oz. 30, 15	lbs. oz. 30, 15	lbs. oz. 30, 15	lbs. oz. 119, 1½	lbs. oz. 92, 13
Date of sprouting	Oct. 10	Oct. 10	Oct. 10	Oct. 8	Oct. 10	Oct. 8	Oct. 8
Commenced flowering	Jan. 4	Jan. 25	Mar. 8	Feb. 8	Mar. 22	Feb. 22	Jan. 25
Full flower†	----	----	----	----	Apr. 15	Mar. 7	----
Height of plant, in inches, on March 15th	26	26	13½	24	18	36	37
Yield of green stuff, in pounds, free from soil, on ½ plot (4x5½ feet, or $\frac{1}{1980}$th part of an acre) weighed March 18, 1899	19¼	17	8¾	14¾	4½	10¼	13¼
Equivalent in pounds per acre	38,115	33,660	17,325	29,205	8,910	20,295	26,235
Equivalent in tons per acre	19	17	8½	14½	4½	10	13
Equivalent on the basis of 100 pounds of seed sown per acre. in pounds	41,066	21,760	56,000	94,400	28,800	17,041	28,267
Equivalent on the basis of 100 pounds of seed sown per acre. in tons	20½	10¾	28	47	14½	8½	14

* Plat 20x20 feet, $\frac{10}{1089}$ acre. † Usually about two weeks later.

TABLE II. COMPARISON OF WEEKLY GROWTH AT BERKELEY.

	Large Blue.	Pink.	Yellow.	Succulent.	Narrow-Leaved.	Small Blue	Small White.
Height of plant, in inches, on—							
October 17	2	1½	1½	(15th) 1	(17th) 1½	(15th) 2	(15th) 2
October 24	4	3	2	(22d) 1	(24th) 2	(22d) 2	(22d) 3
October 31	4	4	2	(29th) 2	(31st) 3	(29th) 5½	(29th) 4
November 6	6	4	3	(4th) 2	(6th) 3	(4th) 7½	(4th) 6½
November 14	6	5	3	(12th) 2	(14th) 4	(12th) 8	(12th) 8
November 21	6	5	3	3	4½	9	8
November 28	6	5	4	4	5	9½	9
December 5	6	6	4	4	6	12	11
December 12	7	6	4	5	6	13	12
December 19	7	6	4	5	6	14	12
January 4	8	6	4	7	6	15	14
January 11	10	7	4	7½	7	16	15
January 18	12	9	4½	9	7½	18	17
January 25	13	12	5	11	9	21	21
February 1	17	15	6	14	9	24	24
February 8	18	16	6	14	9	25	25
February 15	20	18	7	18	10	26½	26½
February 22	24	18	9½	21	12	30	32
March 1	25	22	11	23	15	33	34
March 8	26	24	13	23	16	35	36
March 15	26	26	13½	24	18	36	37

TABLE III. COMPARISON OF YIELD PER ACRE OF VARIOUS LUPINS.

Species.	Pounds of Seed Sown per Acre.	Yield of Green-Manure Per Acre.	Tubercles. March, 1899. (In poor soil.)	Affected by Disease.	Remarks.
L. angustifolius (Narrow-leaved L.)	30 lbs. 15 oz.	4½ tons (8,910 lbs.)	Few, often none.	Liable to infection.	Covers ground well, but unreliable in germination; woody.
L. angustifolius cæruleus (Small Blue L.)	119 lbs. 1¾ oz.	10 tons (20,295 lbs.)	Scarce, often none.	50–70 per cent.	Very reliable; makes good stand, but does not cover ground well; is too woody.
L. angustifolius diploleuca (Small White L.)	92 lbs. 13 oz.	13 tons (26,235 lbs.)	Scarce, often none.	Many plants affected.	Same as L. pilosus cæruleus.
L. luteus sativus (Yellow L.)	30 lbs. 15 oz.	8½ tons (17,325 lbs.)	Few.	Not affected.	Covers ground well, and is very succulent, but unreliable in soils rich in lime. By far the best species for non-calcareous soils.
L. affinis (Succulent L.)	30 lbs. 15 oz.	14½ tons (29,205 lbs.)	Many.	Not affected.	Covers ground well; the most succulent of all species tried, but somewhat unreliable and subject to frost.
L. pilosus roseus (Pink L.)	154 lbs. 11 oz.	17 tons (33,660 lbs.)	Few.	Not affected.	Covers ground well, but is more woody than some species, and in new soil does not always form good growth of tubercles.
L. pilosus cæruleus (Large Blue L.)	92 lbs. 13 oz. (Compare with Angustifolius diploleuca.)	19 tons (38,115 lbs.)	Very numerous.	Not affected.	The best species of any tried; being somewhat woody it may need plowing-in earlier or sowing later, or it may be necessary to mow with a reaper before plowing; makes good tubercles, even in new soil.

solution; in this state the seeds were used for human food by the ancient Egyptians, Greeks, and Romans, and they are still so used in India (imported from the Mediterranean) and in Corsica, Piedmont, Spain, and Portugal.

Use for Forage.—Although the foliage and seeds of lupins are bitter, they are grown for forage purposes in several parts of Europe. The species which are least bitter are the Yellow and the Cruickshanks' Lupin; the former is the one most commonly grown for this purpose on poor sandy soil in southern Europe. On heavy soils, unsuited to the Yellow Lupin, the Small Blue Lupin formerly took its place; this species is more bitter than the Yellow Lupin and was found to be injurious to cattle, it has therefore been abandoned in recent years and its place supplied by the less noxious Small White Lupin. The Large White and Egyptian Lupins are said to be grown for forage to a small extent in southern Europe, but are generally considered too bitter for this purpose.

The foliage of the Yellow Lupin is said to be not inferior to that of clover, and at the same time more bulky; indeed one writer states that, "when cut just at the end of flowering it is the most highly nutritious of all coarse fodders"; the seeds, also, are very fattening when used as an addition to ordinary fodder, and are said to be quite equal to oil-cake. In Germany the average yield of air-dry forage is from 3,640 to 4,550 pounds per acre, but in deep, new, sandy soils it is said to yield 5,460, 7,880, and even 9,100 pounds.

Lupin fodder is said to be fed either green or in the form of hay, but more frequently in the latter condition owing to its bitterness when green.

It is found to be unsuitable for feeding alone, as it then produces the disease called *lupinose*. Cornevin states that lupinose is particularly severe when stock are fed almost exclusively on lupin chaff, only mild when hay, oil-cake, or mangel-wurzel form a certain proportion of the ration, and it is given at intervals. In Germany it has been found that sheep will be affected with lupinose if supplied daily, without interruption, with 500 grammes (17 ounces) of the plant, including well-formed pods and seeds, or 300 grammes (10 ounces) of empty pods, or even with only 100 grammes (3½ ounces) of seeds. Drying does not affect the poisonousness of the plant, and the race, sex, or age of the animal appears to make no difference as to its susceptibility. Sheep, cattle, horses, goats, dogs, and tame rabbits are subject to the disease.

Lupinose appears in two forms, acute or chronic, and is accompanied by lack of appetite, difficult respiration, high fever, spasm, and sometimes vertigo, resulting in death in the first case in four to six days, in the second in fifteen to twenty days. These symptoms, it will be noted, are quite similar to the "loco" of Western pastures.

The Yellow Lupin is considered much more poisonous than the Large White, and the Perennial Lupin less so than any other species. In using *any* species for forage, great care must be taken not to use too much at a time, especially of the seeds, and not to use a lupin ration without intermission. In the event of any cases of lupinose appearing, the use of lupin should be abandoned entirely. Lupins should never be used exclusively in a ration.

For forage purposes the lupins, therefore, do not appear to offer any advantages over other leguminous crops, except as winter growers, and they are certainly more or less dangerous and not to be recommended indiscriminately.

Experiments Conducted at the Central and Substations During the Year 1899–1900.

SUMMARY.

Lupins.—"Small Blue Lupin" (*Lupinus angustifolius cæruleus*, Körn) and "Small White Lupin" (*L. angustifolius diploleuca*, Körn). These varieties are reported by the foremen of the Paso Robles and the Pomona substations as being undoubtedly the best species for the light soils in those localities. At Berkeley the first sowing this year was almost completely destroyed by root-rot, but at Paso Robles no disease affected the plants. At Pomona it was found that by treating affected seed with bluestone solution (1 lb. to 10 gals. of water), the disease was completely checked. A temperature of 20° F., which on February 6, 1899, froze the plants stiff clear to the ground, did not injure them at all. On account of the smaller size and less weight of the seed required per acre, freedom from injury by frosts and by insect pests, it is recommended for more extensive trial on valley soils; bluestoning should, however, be invariably practiced. The blue variety shows some slight advantage over the white. Twenty-six pounds of seed per acre is found sufficient for sowing broadcast; any greater quantity produces too thick a stand for the best health of the plants.

The "Large White Lupin" (*Lupinus albus*, Linn.) is one of the two most satisfactory species under cultivation at Berkeley, Jackson (Foothill station), and Paso Robles. At Pomona it is injured by frost and drought, and does not acquire as great a height as the varieties of *L. angustifolius*. It is not affected by root-rot, but an insect larva sometimes prevents its seeding freely. It has proved valueless on the stiff, red-clay soils of Lake County. One hundred pounds of seed per acre is recommended, the seed being very large.

The "Large Blue Lupin" (*L. pilosus cæruleus*, Hort.) and "Pink Lupin" (*L. pilosus roseus*, Hort.). These two varieties have been among the most successful of any species tried at Berkeley and at Jackson during the last year. At Pomona and Paso Robles they are injured by frost, and at the former station an insect sometimes destroys the buds, so that little or no seed is formed; they are considered a failure at both places. They are not affected by root rot. The seed is large and therefore somewhat costly, but there seems to be no reason why orchardists should not grow enough for their own use. On account of their vigorous habit, heavy weight of foliage, and disease-resisting qualities, these two varieties are recommended for further trial in the thermal belts. It does not appear that one variety possesses any material advantage over the other. One hundred pounds of seed, drilled, per acre is recommended.

Vetches.—The following species of vetch have made excellent winter growths at Berkeley and at Paso Robles. They cover the ground well, making a dense mat of vegetation, and promise to supply a long-felt want on soils which pack down badly with heavy winter rains:

Berkeley; heavy adobe soil: Hairy vetch (*Vicia villosa*), Bush vetch (*V. cracca*), Scarlet vetch (*V. fulgens*), and Common vetch (*V. sativa*).

Paso Robles; sandy soil with hardpan: Hairy vetch (*V. villosa*), Scarlet vetch (*V. fulgens*), White vetch (*V. sativa* var.), Black-purple vetch (*V. atro-purpurea*), and Bithynian vetch (*V. Bithynica*).

The Hairy vetch and Common vetch are particularly recommended for trial in middle and northern California. In addition to their value for green-manuring, they are useful forage plants. A bushel of seed per acre is usually recommended.

Time of Sowing.—September and October have been found by practice to be the best months for effective sowing of these winter green-manure crops. The month of November, in a warm season of gentle showers, is sometimes not too late. Winter sowing has not been found satisfactory. Spring sowing is usually futile, as the plants have not time to acquire a sufficient growth before the season of plowing-in arrives.

Lupin seed can be obtained from Vilmorin-Andrieux & Cie., of Paris, France, or Dammann & Cie., of Naples, Italy, through any of the large importing seed houses. The various species of vetches may be obtained through almost any large seed house.

In ordering seed of the Large Blue Lupin and the Pink Lupin it should be noted that in France they are sometimes sold under the name of *Lupinus hirsutus*. For the sake of accuracy, botanical names should always be used in ordering either lupin or vetch seed.

NOTE ON THE GROWTH OF LUPINS ON CALCAREOUS LANDS.

By E. W. Hilgard.

From vegetation experiments made with lupins in 1896, Heinrich came to the conclusion that as low as 5 per cent of lime or magnesia carbonate present in the soil on which they were planted had a very deleterious effect upon their growth. Our investigations have shown California soils to contain, on an average, over 1 per cent of lime, more than half of which, as a rule, is present in a finely divided form of the carbonate, i. e. more than double the maximum of tolerance as given by Heinrich. As the genus *lupinus* is very much at home with us, covering as it does, sometimes, the ground for miles, the statements of Heinrich (made in the Deutsch Landw. Presse, No. 92, 1896) were somewhat startling. It is but natural to suppose, however, that different species of the genus may act quite differently in this regard; the later experiments of von Graevenitz have proved this to be the case with such species as *L. Cruikshanksii*, *nanus*, and *albus*. I was under the impression, therefore, that the oft-repeated failures of the culture of the European lupin in this State were but a confirmation of Heinrich's experience.

Up to this time these lupins were always planted here in spring, and gave very unsatisfactory results both in clayey and sandy soils. Last year (1897), however, as an experiment, one plot was sown at the beginning of our rainy season, i. e. about the middle of September, and a second plot about a month later. The first sowing had the benefit of a light rain after a week or two, and came up to a good stand; the second plot, however, was very much delayed by dry north winds. Before the advent of our light winter frosts both lots were over their

critical periods and withstood an unusually long spell of cold weather with night frosts. The Blue Lupin soon showed itself to be of the more rapid growth, though the White was somewhat earlier in blooming. By the beginning of March both these varieties were beginning to bloom, and developed side branches very rapidly, so that by the 20th of the month the Blue stood about three feet high and cut something over twenty-three tons of green matter to the acre. The White was not quite so fully developed, and the Yellow stood hardly half as high as the Blue, though in full bloom.

These unexpectedly favorable results of the experiment brought to mind the fact that as far back as the time of Columella, fall-sowing of lupins was recommended to the agriculturists of Italy and southern France. This is of the utmost importance to the Pacific Coast, as without plants of winter growth, a whole year's crop would have to be lost in the process of green-manuring. It is especially important in the green-manuring of vineyards and orchards, where the continuous and thorough cultivation necessary for the conservation of moisture during the summer rapidly burns out the humus; thus rendering this process doubly important for these lands. But no summer crop could be used for the purpose, for the loss of moisture, by allowing a green crop to remain on the land through the dry season, would more than offset any benefit to be derived therefrom. After experimenting for many years with promising leguminous plants for this purpose, our success this year with the Blue Lupin is the first step to the real solution of this important but difficult problem, provided of course, that the high lime-carbonate content of our soils does not render this culture impossible.

The field where these experiments were carried on consists of a heavy, black, clay soil, an old geological swamp formation, but now lying about 200 feet above sea level. It contains about 35 per cent of clay, and over 1 per cent each of lime and magnesia, together with 0.45 per cent of carbonic acid (CO_2); thus forming fully 1 per cent of the carbonate which Heinrich found so unfavorable to lupin growth. In summer when allowed to lie uncultivated, it is traversed by wide cracks, formed by the shrinking of the clay in drying.

As I have not Heinrich's original paper at hand, I can only conjecture that his experiments were conducted on sandy soils, which are commonly used for the cultivation of lupins in Europe. This would be entirely in line with the results of my observations made, and published thirty-five years ago, that while in sandy soils a lime content of .1 per cent is sufficient to produce a characteristic lime vegetation, in heavy clay soils as high as .6 per cent is necessary to produce the same result; a matter of experience which need not be further discussed here. In accordance with this fact, it would not be surprising to find the *unfavorable* influences of lime carbonate also materially weakened in the presence of a large amount of clay.

From these results Heinrich's statement should be modified to read that in sandy soils a content of .46 per cent of lime carbonate is sufficient to forbid the successful culture of lupins, but that in heavy clay soils at least double that quantity can be withstood.

In the practice of green-manuring this fact will doubtless be of great practical significance.

WATTLE BARKS FOR TANNING.

By J. H. Barber.

A small grove of the principal tanbark acacias, or wattle-trees, was planted before the Forestry Station at Santa Monica passed under University control. This included trees of *Acacia pycnantha* ("Golden wattle"), *Acacia decurrens* and *Acacia mollissima* (both known as "Black wattle"), with a few trees of *Acacia dealbata* ("Silver wattle"). The trees being now old enough to yield good tanbark, tests have been made of the barks of the Golden wattle and the two Black wattles, with a view to obtaining data as to the quality of California-grown bark. The tests included analyses of the different barks by the Experiment Station at Berkeley, and practical experiments in the tanning of hides by an experienced and reliable tanner.

From time to time inquiries are received regarding the possibilities of profitable culture of the Black and Golden wattles for tanbark, in California. The following results of tests of these barks made during 1898 will, it is hoped, shed some light on the subject.

The exact age of the trees is unknown, as they were planted before the station passed under University control, but they are said to have been planted in 1890, which would make them about eight years old at time of stripping the bark. Owing to early neglect and consequent stunting of the trees, their growth and the yield of bark cannot be considered at all representative.

Stripping and Yield of Bark.—The bark was stripped from the trees in May, at which time in ordinary years the sap is running freely, and the bark can therefore be easily peeled from the wood. In this dry season, however, the flow of sap was unusually scanty, rendering stripping a difficult and slow operation, especially in the case of the less vigorous trees. This is a point to be borne in mind in choosing the time for harvesting the crop.

Measurements were made of a fair average tree of each species, giving the following dimensions and yield of bark:

Sample Trees.

Acacia decurrens (syn. *A. decurrens* var. *normalis*).

Extreme height of tree	35	feet.
Length of trunk stripped	32	feet.
Girth at 3 feet from ground	14½	inches.
Girth at 15 feet from ground	10¼	inches.
Girth at 32 feet from ground	1½	inches.
Thickness of bark	3/16 to 1/16	inch.
Amount of bark from main stem (green)	17¼	pounds.

The tree tapered evenly, and had no branches large enough to be worth stripping.

Acacia mollissima (syn. *A. decurrens* var. *mollis*).

Extreme height of tree	32	feet.
Length of trunk stripped	29	feet.
Girth at 3 feet from ground	15	inches.
Girth at 15 feet from ground	9½	inches.
Girth at 29 feet from ground	1½	inches.
Thickness of bark	3/16 to 1/16	inch.
Amount of bark from main stem (green)	18	pounds.

Tree tapered evenly, and had no branches worth stripping.

Acacia pycnantha.

Extreme height of tree	23½ feet.
Length of trunk stripped	20½ feet.
Girth at 3 feet from ground	16 inches.
Girth at 15 feet from ground	7 inches.
Girth at 20½ feet from ground	1½ inches.
Thickness of bark	¼ to $\frac{1}{16}$ inch.
Amount of bark from main stem (green)	22 pounds.

Several branches of this tree were stripped, and yielded an additional two pounds of bark.

The thinness of the bark, and consequent small yield per tree, will be noticed, especially in the Black wattles. This, however, would naturally be looked for in lank, stunted growth, such as the trees from which these barks were taken; and this, together with the correspondingly high percentage of tannin, to be noticed hereafter, forms part of the calculation of the yield of a plantation, which is usually not cut all at the same time, but a part each year after the fifth or sixth, in regular rotation.

Analyses of Barks.—Fair average samples of the three barks were sent to Berkeley, and analyzed in the laboratory of the Central Station by George E. Colby. Besides the bark from the main stems (the most important thing), samples were analyzed, also, of bark from the branches and larger roots. The results of the analyses appear below:

Determinations of Tanning Material in Black and Golden Wattles.

Samples from trees at the Santa Monica Forestry Station.

	Water Per Cent, Air-Dried.	Tannin Per Cent.	
		Air-Dried.	Water-Free Substance.
Acacia decurrens ("*Black Wattle*").			
Bark from main stems	6.53	42.48	45.83
Bark from branches	8.26	36.57	39.98
Bark from large roots	5.28	31.35	33.10
Acacia mollissima ("*Black Wattle*").			
Bark from main stems	7.60	45.98	49.76
Bark from branches	8.02	42.98	46.66
Bark from large roots	7.89	32.37	35.18
Acacia pycnantha ("*Golden Wattle*").			
Bark from main stems	9.32	41.80	46.09
Bark from branches	8.67	38.66	42.34
Bark from large roots	7.10	47.02	50.58

Note.—The water percentages in the above table do not represent the total water content of the various barks, as they were partially dried before being shipped to Berkeley.

The important practical point in the analyses is, of course, the tannin in the air-dried bark, but for purposes of comparison with analyses made elsewhere the percentage of tannin in the water-free substance, i. e., the absolute percentage of tannin in the bark, is necessary. We may profitably compare these results with figures given by Mr. J. H. Maiden, from analyses made by him of Australian barks and published in his "Wattles and Wattle Barks," Sydney, 1891.

The highest percentage in bark of *Acacia decurrens* given by Mr. Maiden is 32.33 per cent tannin, as against 45.83 obtained here, a difference of 13.5 per cent in favor of the California-grown bark. In the case of *Acacia mollissima*, out of twenty analyses made by Mr. Maiden the best gave 36.3 per cent tannin, the difference in this case being almost exactly the same, 13.46 per cent. Of twenty tests of *Acacia pycnantha*, leaving out of account an exceptional bark which yielded 46.47 per cent tannin after having been in storage seven years, the best result obtained was 42.1 per cent, which is very close to the percentage obtained here. The high percentages obtained here from *Acacia decurrens* and *A. mollissima* are undoubtedly due in large part to the remarkable thinness of the bark. Thus it appears that smallness of yield on account of thin bark may be offset to some extent by a higher percentage of tannin.

In these samples the bark from the branches proved uniformly poorer in tannin than that of the main stems, as was to be expected from the more actively growing portions of the trees. The bark from the larger roots contained less tannin in the case of the two Black wattles, but markedly more in the Golden wattle. These results, however, were obtained from much smaller samples than those of the main bark, and so are, perhaps, hardly as conclusive.

Practical Tests.—In addition to the analyses of the barks, a series of practical tests in the actual tanning of skins was undertaken by Mr. James Cook, the well-known tanner, of Los Angeles, Cal. These tests were made on what are known in the trade as "light russets," i. e., sheepskins tanned to light-colored leather. The ordinary commercial tanning process was employed, except that the wattle barks were not ground, on account of lack of facilities, and therefore the results were not as good as they would have been had these barks been ground to powder as is the oak bark ordinarily used. Notwithstanding this handicap the tests proved highly satisfactory, as will be seen from the following report by Mr. Cook:

LIGHT RUSSETS TANNED BY WATTLE BARKS.

100 lbs.	*Acacia decurrens*	bark (air-dried)	tanned	106 lbs.	leather.
100 "	*A. mollissima*	"	"	112 "	"
100 "	*A. pycnantha*	"	"	96 "	"

These practical results coincide approximately with the relative percentages of tannin in the air-dried barks obtained by the analyses at Berkeley.

Sulfuric acid was used in the tan liquors, as usual in tanning russets, but less (about two fifths) was added to the wattle liquors than is ordinarily added to oak-tan liquor.

According to Mr. Cook 100 pounds of the best Santa Cruz oak bark, *ground to powder*, will tan about 80 pounds of light russets. Had the wattle barks been ground, he considers that much better results would have been obtained than were actually had. The wattle barks made a soft leather like that tanned by cañaigre. The coloring produced was light, with no dark background, the leather thus being unsuitable for stamping where dark lines are desired. This lack of coloring matter Mr. Cook considers no drawback, as the color could readily be supplied

by the cutch or *Terra Japonica* ordinarily used for this purpose. He ranks the wattle barks as much superior to the best oak bark on light leathers. On heavy leathers no test was made, but Mr. Cook thinks that with good tanning these barks would undoubtedly give better results than oak. He has confidence in the value of wattle barks for tanning purposes, and in his opinion the barks tested are "as good value at $28 a ton as oak bark at $18 a ton."

CULTURE WORK

AT THE

CENTRAL STATION AND SUBSTATIONS.

SYNOPSIS OF METEOROLOGICAL OBSERVATIONS AT BERKELEY, FOR THE YEAR ENDING JUNE 30, 1898.

University of California—Students' Observatory: Associate Professor ARMIN O. LEUSCHNER, Director.

Latitude, north 37° 52' 23.6". Longitude, west from Greenwich, 122° 15' 40.8". Height of cistern of barometer above sea, 320 feet.

Compiled by YOSHI KUNO, Assistant in Astronomy.

	July. Date.	July.	August. Date.	August.	September. Date.	September.
BAROMETER.	Date.	Inches.	Date.	Inches.	Date.	Inches.
Mean barometer for the month		29.945		29.962		29.992
Highest barometer for the month	26th, 8 A. M.	30.112	30th, 8 A. M.	30.123	18th, 8 A. M.	30.132
Lowest barometer for the month	2d, 8 P. M.	29.793	2d, 8 P. M.	29.830	1st, 8 P. M.	29.770
Monthly range		0.319		0.293		0.362
Highest daily average	26th	30.077	29th	30.073	28th	30.084
Lowest daily average	3d	29.837	3d	29.847	1st	29.800
THERMOMETER.		Degrees.		Degrees.		Degrees.
Mean temperature of the month (Fahr.)		59.9		58.3		59.6
Mean temperature of the warmest day	8th	66.5	10th	62.8	16th	69.1
Mean temperature of the coldest day	27th	54.7	2d	55.0	28th	55.2
Maximum temperature	12th	84.3	21st	75.4	16th	89.0
Minimum temperature	7th	51.2	2d and 3d	52.1	29th	48.4
Monthly range		33.1		23.3		40.6
Greatest daily variation	12th	27.1	21st	21.1	16th	29.2
Least daily variation	22d	11.0	26th	6.8	25th	5.5
Mean daily range of temperature		19.0		13.2		15.0
Mean lowest temperature of the month		53.8		54.5		55.1
Mean highest temperature of the month		72.8		67.7		70.1
PRECIPITATION.		Inches.		Inches.		Inches.
Rainfall during the month of July		0.000		0.000		0.200
Rainfall since July 1, 1897		0.000		0.000		0.200
Rainfall during same period last year		0.000		0.904		1.664
Dew and fog during July		0.000		0.000		0.001
Dew and fog since July 1, 1897		0.000		0.000		0.001
Dew and fog during same period last year		0.000		0.000		0.006
RELATIVE HUMIDITY.		Per Cent.		Per Cent.		Per Cent.
Mean relative humidity of the month		80.9		87.2		86.1
Greatest daily variation	2d, 3d	10.0	8th	14.0	15th	22.0
Least daily variation	1, 15, 20, 22	0.0	3d, 25th	0.0	10th, 17th, 29th	0.0
Maximum humidity	27th, 8 A. M.	91.0	24th, 8 P. M.	95.0	9th, 8 P. M.	97.0
Minimum humidity	2d, 8 P. M.	69.0	8th, 8 A. M.	72.0	15th, 8 P. M.	62.0
Monthly range		22.0		23.0		35.0
WEATHER.						
Number of clear days		19		4		13
Number of fair days		8		12		11
Number of cloudy days		4		15		6
Total		31		31		30
Of the total number there were:						
Foggy days		11		14		2
Days on which rain fell		0		0		3
WIND OBSERVATIONS.						
Direction of prevailing wind		S. and Calm		S. and Calm		S. and Calm

	October. Date.	October.	November. Date.	November.	December. Date.	December.	January. Date.	January.
BAROMETER.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.
Mean barometer for the month		30.028		30.148		30.211		30.149
Highest barometer for the month	15th, 8 A. M.	30.219	8th, 8 A. M.	30.331	25th, 8 A. M.	30.486	19th, 8 A. M.	30.370
Lowest barometer for the month	13th, 8 A. M.	29.763	9th, 8 P. M.	29.918	14th, 8 A. M.	29.828	9th, 8 P. M.	29.851
Monthly range		0.456		0.413		0.658		0.519
Highest daily average	15th	30.202	7th	30.302	24th, 28th	30.385	19th	30.341
Lowest daily average	13th	29.790	19th	29.977	14th	29.888	9th	29.888
THERMOMETER.		Degrees.		Degrees.		Degrees.		Degrees.
Mean temperature of the month (Fahr.)		56.2		49.5		46.4		43.3
Mean temperature of the warmest day	5th	65.6	10th	53.8	11th	54.7	6th	49.1
Mean temperature of the coldest day	14th	49.7	26th	44.8	20th	40.2	10th	36.7
Maximum temperature	4th	82.9	10th	65.3	6th	60.6	2d	59.1
Minimum temperature	14th	44.8	15th and 26th	39.8	19th	34.8	12th	32.9
Monthly range		38.1		25.5		25.8		26.2
Greatest daily variation	4th	31.3	17th	19.2	28th	15.9	29th	19.0
Least daily variation	12th	3.9	12th	5.6	7th	6.3	6th	5.0
Mean daily range of temperature		12.7		12.1		12.1		12.1
Mean lowest temperature of the month		51.9		45.0		42.1		38.8
Mean highest temperature of the month		64.6		57.1		54.2		50.9
PRECIPITATION.		Inches.		Inches.		Inches.		Inches.
Rainfall during the month of July		2.481		1.576		2.713		1.540
Rainfall since July 1, 1897		2.681		4.257		6.970		8.510
Rainfall during same period last year		3.572		8.725		13.640		17.354
Dew and fog during July		0.003		0.011		0.004		0.024
Dew and fog since July 1, 1897		0.004		0.015		0.019		0.043
Dew and fog during same period last year		0.008		0.008		0.041		0.042
RELATIVE HUMIDITY.		Per Cent.		Per Cent.		Per Cent.		Per Cent.
Mean relative humidity of the month		84.0		84.9		81.88		80.35
Greatest daily variation	15th	28.5	10th	18.0	1st	28.00	26th	36.00
Least daily variation	9th	0.0	9th, 12th, 22d	0.0	11th	0.0	17th	0.0
Maximum humidity	11th, 8 A. M.; 12th, 8 P. M.; 23d, 8 A. M.	94.0	19th, 8 P. M.; 20th, 24th, 8 A. M.	94.0	8th, 8 A. M.	97.0	26th, 8 P. M.	94.0
Minimum humidity	26th, 8 P. M.	48.0	15th, 8 P. M.	61.0	2d, 8 A. M.	52.5	26th, 8 A. M.	58.0
Monthly range		46.0		33.0		44.5		36.0
WEATHER.								
Number of clear days		14		17		20		16
Number of fair days		10		2		4		6
Number of cloudy days		7		11		7		9
Total		31		30		31		31
Of the total number there were:								
Foggy days		3		5		1		2
Days on which rain fell		5		7		6		9
WIND OBSERVATIONS.								
Direction of prevailing wind		N. and Calm		S. E. and Calm		N. and Calm		N. and Calm

	February. Date.	February.	March. Date.	March.	April. Date.	April.	May. Date.	May.	June. Date.	June.
BAROMETER.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.
Mean barometer for the month		30.113		30.072		30.039		29.980		29.944
Highest barometer for the month	13th, 8 A. M.	30.384	27th, 8 A. M.	30.435	3d, 8 A. M.	30.294	16th, 8 P. M.	30.140	2d, 8 A. M.	30.172
Lowest barometer for the month	24th, 8 A. M.	29.709	9th, 8 P. M.	29.653	29th, 8 P. M.	29.565	15th, 8 A. M.	29.715	29th, 8 P. M.	29.723
Monthly range		0.675		0.782		0.729		0.425		0.449
Highest daily average	13th	30.339	27th	30.376	3d	30.233	5th	30.091	2d	30.149
Lowest daily average	24th	29.803	9th	29.798	29th	29.662	14th	29.795	16th	29.786
THERMOMETER.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.
Mean temperature of the month (Fahr.)		49.7		48.3		54.3		53.4		60.8
Mean temperature of the warmest day	14th	56.3	11th	57.9	12th	66.7	31st	57.3	30th	75.5
Mean temperature of the coldest day	17th	44.3	16th	41.0	2d	47.1	13th	50.1	10th	54.0
Maximum temperature	14th	68.8	11th	73.4	12th	85.3	24th	68.4	4th	90.8
Minimum temperature	22d	38.4	18th	36.0	3d	40.9	23d	44.8	2d	49.2
Monthly range		30.4		37.4		44.4		23.6		41.6
Greatest daily variation	14th	18.8	11th	23.5	11th	30.4	23d	22.2	30th	37.4
Least daily variation	24th	5.0	12th	3.5	19th	7.8	13th	3.6	9th	4.9
Mean daily range of temperature		11.7		15.6		17.5		13.3		18.7
Mean lowest temperature of the month		46.0		43.0		47.6		48.5		53.7
Mean highest temperature of the month		57.7		58.6		65.1		61.8		72.4
PRECIPITATION.		Inches.		Inches.		Inches.		Inches.		Inches.
Rainfall during the month of July		3.279		0.312		0.189		1.873		0.245
Rainfall since July 1, 1897		11.789		12.101		12.290		14.163		14.408
Rainfall during same period last year		22.036		28.005		28.450		28.649		28.944
Dew and fog during July		0.016		0.007		0.000		0.000		0.000
Dew and fog since July 1, 1897		0.059		0.066		0.066		0.066		0.066
Dew and fog during same period last year		0.042		0.042		0.068		0.080		0.080
RELATIVE HUMIDITY.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.
Mean relative humidity of the month		87.90		84.7		83.6		86.2		83.7
Greatest daily variation	24th	14.50	10th, 22d	39.0	11th	35.0	14th	17.0	5th	26.0
Least daily variation	7th, 27th	0.0	6th	0.0	18th	0.0	3d, 17th, 27th	0.0	12th, 23d	0.0
Maximum humidity	11th, 13th, 8 A. M.; 20th, 8 P. M.	94.0	10th, 8 P. M.	99.0	8th, 8 A. M.; 11th, 8 P. M.	93.0	16th, 8 A. M.	94.2	30th, 8 P. M.	100.0
Minimum humidity	4th, 8 P. M.	74.0	22d, 8 A. M.	58.0	11th, 8 A. M.	58.0	8th, 8 A. M.	73.0	4th, 8 A. M.	63.0
Monthly range		20.0		41.0		35.0		21.2		37.5
WEATHER.										
Number of clear days		12		19		15		8		14
Number of fair days		5		4		9		6		10
Number of cloudy days		11		8		6		17		6
Total		28		31		30		31		30
Of the total number there were:										
Foggy days		4		2		0		0		4
Days on which rain fell		9		3		1		6		3
WIND OBSERVATIONS.										
Direction of prevailing wind		S. E. and Calm		N. W. and Calm		S. and Calm		S. and Calm		S. and Calm

SYNOPSIS OF METEOROLOGICAL OBSERVATIONS AT BERKELEY, FOR THE YEAR ENDING JUNE 30, 1899.

University of California—Students' Observatory: Associate Professor ARMIN O. LEUSCHNER, Director.

Latitude, north 37° 52' 23.6". Longitude, west from Greenwich, 122° 15' 40.8". Height of cistern of barometer above sea, 320 feet.

Compiled by YOSHI KUNO, Assistant in Astronomy.

	JULY.		AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.	
BAROMETER.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.
Mean barometer for the month		29.946		29.913		29.937		30.048		30.101		30.220
Highest barometer for the month	13th, 22d, 8 A. M.	30.108	25th, 8 A. M.	30.045	21st, 27th, 8 A. M.	30.047	24th, 8 A. M.	30.226	21st, 8 A. M.	30.335	24th, 8 A. M.	30.634
Lowest barometer for the month	15th, 8 P. M.	29.786	31st, 8 P. M.	29.694	11th, 8 P. M.	29.822	18th, 8 P. M.	29.853	19th, 8 A. M.	29.855	8th, 8 P. M.	29.985
Monthly range		0.322		0.351		0.225		0.373		0.480		0.649
Highest daily average	22d	30.075	25th	30.032	8th	30.022	24th	30.192	21st	30.273	24th	30.594
Lowest daily average	1st	29.814	31st	29.725	24th	29.826	18th	29.897	19th	29.903	8th	30.025
THERMOMETER.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.
Mean temperature of the month (Fahr.)		57.9		58.3		58.5		57.4		51.3		46.3
Mean temperature of the warmest day	1st	72.8	11th	64.0	11th	62.8	16th	64.9	5th	68.3	6th	57.4
Mean temperature of the coldest day	11th	54.6	22d	55.3	30th	54.8	1st	51.4	20th	45.0	31st	37.5
Maximum temperature	1st	94.4	9th	77.9	11th	81.9	19th	79.8	5th	77.7	7th	65.0
Minimum temperature	13th	50.4	22d	51.2	2d, 17th, 29th	51.4	4th	47.0	20th	40.7	31st	33.9
Monthly range		44.0		26.7		30.5		32.8		37.0		31.1
Greatest daily variation	1st	31.2	9th	24.6	11th	27.7	19th	26.1	5th	20.2	8th	19.1
Least daily variation	8th	10.9	2d	8.3	26th	7.4	30th	5.8	22d	6.4	14th	4.5
Mean daily range of temperature		16.3		14.6		14.0		15.0		13.4		12.2
Mean lowest temperature of the month		53.8		54.4		54.2		53.1		47.0		42.1
Mean highest temperature of the month		70.1		69.0		68.2		68.1		60.4		54.3
PRECIPITATION.		Inches.		Inches.		Inches.		Inches.		Inches.		Inches.
Rainfall during the month		0.000		0.043		0.926		1.877		0.973		1.218
Rainfall since July 1, 1898		0.000		0.043		0.969		2.846		3.819		5.037
Rainfall during same period last year		0.000		0.000		0.200		2.681		4.257		6.970
Dew and fog during July		0.000		0.000		0.006		0.011		0.038		0.024
Dew and fog since July 1, 1898		0.000		0.000		0.006		0.017		0.055		0.079
Dew and fog during same period last year		0.000		0.000		0.001		0.004		0.015		0.019
RELATIVE HUMIDITY.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.
Mean relative humidity of the month		91.5		88.1		88.3		83.9		81.6		81.1
Greatest daily variation	1st	31.0	13th	17.0	28th	18.0	16th	37.3	13th	21.0	7th	35.0
Least daily variation	5th, 10th	0.0	3d	0.0	12th	0.0	4th	1.0	27th	2.0	11th	0.6
Maximum humidity	7th, 9th, 8 P. M.	100.0	1st, 8 P. M.	100.0	1st, 16th, 20th, 21st, 8 P. M.	100.0	16th, 8 P. M.	95.0	24th, 8 P. M.	97.8	5th, 8 P. M.	97.0
Minimum humidity	1st, 8 A. M.	61.0	27th, 8 A. M.	79.5	29th, 8 P. M.	70.8	20th, 8 A. M.	54.8	5th, 8 A. M.	55.0	8th, 8 P. M.	57.0
Monthly range		39.0		20.5		29.2		40.2		42.8		40.0
WEATHER.												
Number of clear days		10		7		10		15		14		10
Number of fair days		16		14		11		11		8		13
Number of cloudy days		5		10		9		5		8		8
Total		31		31		30		31		30		31
Of the total number there were: Foggy days		1		8		8		1		6		4
Days on which rain fell		0		2		4		6		5		5
WIND OBSERVATIONS.												
Description of prevailing wind		S. and Calm		S. and Calm		S. and Calm		S. and Calm		N. and Calm		N.E. and Calm

	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.	
BAROMETER.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.
Mean barometer for the month		30.148		30.186		30.062		30.051		30.038		29.958
Highest barometer for the month	5th, 8 A. M.	30.405	8th, 8 A. M.	30.507	3d, 8 P. M.	30.354	26th, 8 P. M.	30.240	3d, 8 A. M.	30.183	19th, 8 A. M.	30.127
Lowest barometer for the month	10th, 8 A. M.	29.436	1st, 8 P. M.	29.794	15th, 8 P. M.	29.628	23d, 8 P. M.	29.780	31st, 8 P. M.	29.760	5th, 8 P. M.	29.745
Monthly range		0.969		0.713		0.726		0.460		0.423		0.382
Highest daily average	5th	30.400	7th	30.496	3d	30.353	3d	30.225	2d	30.149	19th	30.115
Lowest daily average	10th	29.526	1st	29.813	15th	29.704	23d	29.792	31st	29.822	5th	29.790
THERMOMETER.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.		Degrees.
Mean temperature of the month (Fahr.)		50.2		48.0		49.8		52.8		53.1		57.9
Mean temperature of the warmest day	26th	65.6	18th	68.5	5th	57.8	7th	62.1	10th	57.8	13th	64.0
Mean temperature of the coldest day	5th	40.4	4th	32.8	16th	44.0	23d	47.0	1st	48.1	4th	53.5
Maximum temperature	26th	77.0	18th	79.5	6th	72.5	20th	81.5	10th	80.5	14th	79.7
Minimum temperature	1st	35.5	4th	29.9	17th	39.0	28th	41.2	1st	39.9	2d	47.8
Monthly range		41.5		49.6		33.5		40.3		40.6		31.9
Greatest daily variation	30th	20.7	20th	22.3	4th	23.0	20th	30.0	10th	29.0	5th	25.2
Least daily variation	16th	4.5	28th	7.6	23d	2.3	23d	7.0	31st	3.4	19th	6.8
Mean daily range of temperature		7.8		14.3		12.7		17.1		17.0		18.0
Mean lowest temperature of the month		46.1		43.7		45.6		46.9		46.9		52.2
Mean highest temperature of the month		53.9		58.0		58.3		64.0		63.9		70.2
PRECIPITATION.		Inches.		Inches.		Inches.		Inches.		Inches.		Inches.
Rainfall during the month		5.905		0.217		13.192		1.562		1.699		0.050
Rainfall since July 1, 1898		10.942		11.159		24.351		25.913		27.612		27.662
Rainfall during same period last year		8.510		11.789		12.101		12.290		14.183		14.408
Dew and fog during July		0.003		0.052		0.020		0.011		0.003		0.018
Dew and fog since July 1, 1898		0.082		0.134		0.154		0.165		0.168		0.186
Dew and fog during same period last year		0.043		0.059		0.066		0.066		0.066		0.066
RELATIVE HUMIDITY.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.
Mean relative humidity of the month		89.1		79.5		87.1		85.5		83.7		85.6
Greatest daily variation	30th	26.0	18th	25.5	6th	14.0	24th	26.6	8th	18.0	11th	13.0
Least daily variation	27th	0.6	11th	0.3	1st	0.0	14th, 11th	1.0	4th, 31st	0.0	5th, 24th	0.0
Maximum humidity	16th, 8 A. M.	98.2	3d, 8 A. M.	100.0	23d, 8 A. M.	98.8	2d, 3d, 4th, 27th, 8 A. M., 25th, 8 P. M.	93.0	8th, 29th, 31st, 8 A. M., 31st, 8 P. M.	94.0	5th, 8 A. M., 5th, 10th, 8 P. M.	97.0
Minimum humidity	30th, 8 P. M.	64.0	18th, 8 P. M.	56.0	6th, 8 P. M.	70.0	24th, 8 P. M.	65.4	14th, 8 A. M.	70.5	13th, 8 P. M.	74.2
Monthly range		34.2		44.0		28.8		27.6		23.5		22.8
WEATHER.												
Number of clear days		8		11		4		9		13		13
Number of fair days		8		15		11		13		9		7
Number of cloudy days		15		2		16		8		9		10
Total		31		28		31		30		31		30
Of the total number there were: Foggy days		0		5		2		4		3		7
Days on which rain fell		12		3		14		6		3		1
WIND OBSERVATIONS.												
Description of prevailing wind		S., S.E., E. and Calm		N. and Calm		S. and Calm		S. and Calm		S. and Calm		S.W. and Calm

CENTRAL EXPERIMENT STATION.

Berkeley, Alameda County.

DISTRIBUTION OF SEEDS, PLANTS, CUTTINGS, ETC.

By Edward J. Wickson.

The distribution of seeds, plants, cuttings, etc., has been prosecuted since the last published report with increasing interest. Reports of the results of trials by the hundreds of voluntary experimenters, who furnish us interesting and important statements, are furnishing valuable data, and supplementing the observations at our own Culture Stations in the determination of local adaptations of many important economic plants. We earnestly solicit further correspondence to show the results of continued trial and observation, and suggest that all who have not yet advised us of their successes and failures take early occasion to do so.

The work began more than twenty years ago, but its beginnings were small. The records of the distribution since 1886 furnish the following condensed review for the last fourteen years:

Ounces of Seeds Distributed.

	1886-97.	1897-8.	1898-9.
Cereals	21,896	--------	--------
Fiber plants	3,332	240	--------
Forage plants	30,602	769	2,207
Plants for green-manuring	5,948	384	864
Vegetables	12,729	689	4,043
Trees	4,628	1,726	1,084
Miscellaneous	4,353	76	172

Number of Plants and Scions.

Trees of 30 kinds	6,938	--------	626
Fiber plants	1,530	--------	--------
Forage plants (roots)	18,843	800	--------
Grapes, figs, and olives (cuttings and rooted)	48,190	4,397	590
Mulberries and osier willows (cuttings and rooted)	13,105	-------	1,190
Miscellaneous	4,842	729	845

Since our last report, two seed bulletins have been issued, giving in detail the offerings for 1897–8 and 1898–9. The summaries of the last five years, with classification of materials, amounts distributed, and the financial phases of the distribution are given below:

Number of Plants and Cuttings Distributed.

Name.	1894–5.	1895–6.	1896–7.	1897–8.	1898–9.
Forage—Buffalo grass				340	
Jesuit's tea	43				
Flat pea roots	1,820	580		270	
Texas blue-grass roots	400	456	198	190	
Sacaline		174			
Australian saltbush		402			
Paper Mulberry		318			
Guavas (5 kinds)		435			
Grapevines—Persian (19 kinds)	1,358	1,733	2,803	1,022	
Italian wine (43 kinds)	168				
Selected resistants (5 kinds)			23,345	3,375	590
Cañaigre roots			36	60	15
Jerusalem artichokes (2 kinds)			912	590	830
Silk cotton tree			35		
Olive cuttings (19 kinds)	699				
Sugar cane	76	200			
Rhubarb				79	
Asia Minor willow					1,190
South African cypress					260
Northern Spy apple roots and scions					366
Totals	4,564	4,298	27,329	5,926	3,251

Weight, in Ounces, of Seeds Distributed.

Name.	1894–5.	1895–6.	1896–7.	1897–8.	1898–9.
Cereals—Algerian wheat (16 kinds)			576		
Hackett's Australian wheat	544	800			
Rice	272				
Nepaul barley		2,256			
Buckwheat (5 kinds)		432			
Forage—Australian saltbushes	254	3,830	408	336	1,121
Saghalin polygonum	486				
Modiola		235	99	78	150
Orach		47			
Grasses—Awnless brome		116	21	128	
Tall oat	53	170	84	68	
Schrader's brome	304	300	82	40	
Japanese wheat	360	180	42		
Many-flowered millet	144	58	40	7	
Hairy-flowered paspalum	112	172	120	8	
Yellow oat				26	
Teff				27	
Crab				9	
Texas millet				11	
Tall grama				15	
Various-leaved fescue				16	
Tall fescue					81
Eleusine					78
Hairy vetch					426
Iris pabularia					138
Sorghum (5 kinds)					213
Garden—Melde's perennial bean	226	394			
Irvine's hybrid perennial bean	244	380			
New Zealand spinach	85	212			
Sweet corn (2 kinds)	162		1,140	160	674
Jersey kale			332		
Roselle			716	146	122
Edible-pod pea			447	186	248
Ceylon pea		975			
New short white carrot				83	111
Veitch's climbing bean				114	234
Red Etampes pumpkin					248
Persian melon (10 kinds)					1,131
King's acre cream vegetable marrow					91
Asparagus pea					632
Soya bean					488
Big Hiller lentil					64

WEIGHT, IN OUNCES, OF SEEDS DISTRIBUTED—Continued.

Name.	1894-5.	1895-6.	1896-7.	1897-8.	1898-9.
Green-manuring—Fenugreek				348	444
Snail clover		3,648	1,872	36	420
Square-pod pea (2 kinds)		81	138		
Crimson clover		201			
Sundry—English oak acorns		252			
Eucalypts (13 kinds)			1,229	815	
Carob			908		
Flax (5 kinds)		752		96	
Rose poppy		199			
Tobacco (35 kinds)		941	661		
Tree tomato of Jamaica	264				
Cañaigre	192		68	76	8
Cotton				144	
Acacias (5 kinds)				310	
Miscellaneous trees (14 kinds)				601	1,084
Red-flowered passion vine					164
Totals	3,702	16,631	8,983	3,884	8,370

FINANCIAL STATEMENT FOR SIX YEARS.

	1893-4.	1894-5.	1895-6.	1896-7.	1897-8.	1898-9.
Receipts.						
Cash from applicants	$323 63	$296 80	$476 62	$407 27	$213 39	$310 83
Assistance fr. Agr. Dept. of Univ.	12 00	41 00	23 50		19 00	
Total receipts	$335 63	$337 80	$500 12	$407 27	$232 39	$310 83
Expenditures.						
Packing material for seeds	$5 00	$13 55	$25 80	$12 70	$11 00	$12 30
Packing material for plants	28 35	21 35	27 15	48 30	22 60	15 85
Postage, cartage, etc.	75 34	68 00	148 21	100 41	61 20	66 38
Stationery	6 90	4 90	13 55	13 28	6 23	7 90
Wages	156 01	163 24	251 25	219 02	*123 38	*190 40
Total expense	$271 60	$271 04	$465 96	$393 71	$224 41	$292 83
Cash (unfilled orders) returned	64 03	66 76	34 16	13 56	7 98	18 00
	$335 63	$337 80	$500 12	$407 27	$232 39	$310 83

*$30 80 of amount due in 1897-8 was paid in 1898-9.

EXTENT OF DISTRIBUTION FOR EIGHT YEARS.

	1891-2.	1892-3.	1893-4.	1894-5.	1895-6.	1896-7.	1897-8.	1898-9.
Number of applicants supplied	438	410	578	925	1,477	1,169	637	846
Packages sent by mail	612	517	761	1,163	2,027	1,446	861	984
Packages sent by express	46	124	56	12	54	171	81	43
Offices	267	225	329	382	486	427	302	360
Counties reached	47	46	48	53	54	52	51	52

REPORTS ON VARIOUS SEEDS AND PLANTS INCLUDED IN THE UNIVERSITY DISTRIBUTION.

By Edward J. Wickson.

The reports from the hundreds of voluntary experimenters who receive material from the University distribution are of material assistance in determining the local adaptations of various growths, as has already been mentioned. The information thus secured is of direct value in the preparation of University bulletins and reports. It enters into the regular class instruction at Berkeley and into the lecture and question work at Farmers' Institutes. It unquestionably enables us to understand better the relation of economic plants to local conditions of soil and climate, and thus involves an important educational value wholly apart from the direct and practical value which these introductions in themselves render to the agriculture of the State.

It is impossible in the space which can be properly given to this branch of the Station work to include all the reports which we receive, but care is taken in condensation to reflect fairly the diverse phases which arise in the experience of different experimenters. Selection has to be made also of those plants whose characters and behavior seem to be most clearly made out.

ROSELLE (*Hibiscus sabdariffa*).

This interesting plant, resembling in its growth okra or gumbo, is a native of tropical Asia and Africa, and has been widely distributed through semi-tropical countries, where it has been found to possess considerable resistance to drought and to yield very acceptable food products. The stems also contain a silky fiber of which some use is made in India. For the seed we are indebted to Mr. A. Neustadt of San Francisco, who imported it from Queensland. The plant made very satisfactory growth at our Southern California substation, near Pomona, and Mr. J. W. Mills, foreman, furnishes the following notes of its local growth and uses:

> The plant is very ornamental, the dark red stems and pods showing through the rather scant dark green foliage. The flowers are of a yellowish white with a dark red center, two inches across and lasting only an hour or so during fair weather. The juice extracted from the fleshy calyces or husks is used with water to make an acidulous cooling drink, but is of most value in jelly-making. The mucilaginous properties of the juice render the "setting" of the jelly certain with a reasonable amount of cooking. The dark cherry color of the jelly and the sprightly acid make it nearly if not equal to currant jelly. The color of the husk is very much more vivid when the pod is green, and in this condition the pod and contents can be cooked and the juice strained. If, however, it is desired to save the seed, the pod must be allowed to ripen and the husks can then be used for jelly-making. If the husk is dried it does not lose its acidity or color. This allows it to be shipped in a condensed form and it can afterward be made into jelly. Irrigated plants produce a more highly colored fruit, but come into bearing later. Unirrigated plants put their strength into fruit. In 1899 our plants did not grow over two feet high, had few leaves, no lateral branches except from the base, and every stem was lined with pods from the bottom up. The pods were about half the usual size. The plants had no water given them except when they were transplanted.
>
> We like jelly made from Satsuma plum much better; though Roselle is excellent, and enough for a family can be grown in a back yard and in one season.

As the plant will endure quite heated and arid situations it promises to be of much value for jelly-making where currants do not thrive. When the character of the plant was made known through our distribu-

tion bulletin of 1896–7, there was a wide demand for the seed, and a number of our correspondents, on the basis of their first year's experience, subsequently enlarged their plantations to commercial limits. We have received very full reports of local trials, and they show that wherever a long frostless season is combined with high summer heat the plant will make large returns. It will fail, however, where early autumn frosts occur before it reaches its rather late fruiting. The following outline of reports fixes its value and adaptations very definitely:

Wm. E. Whitmore, Whitmore, Shasta County.—Roselle: planted in May and June, came up and was almost in bloom when the frosts of October cut them down.

B. H. Brubaker, Corning, Tehama County.—The Roselle plant under heavy irrigation was a perfect success except the pods.

Claud D. Tribble, Lotus, El Dorado County.—Roselle were planted April 30th and grew very slowly, probably because they were watered too much and were planted in the shade. But they bore countless numbers of pods and grew healthy and thrifty. The light frosts did not affect them, and they lived until recently (December 7th). One gallon of pods made one quart of jelly, which we consider as very fine. They are well adapted to our dry soil.

George B. Pearce, Jr., Paradise, Butte County.—I planted the Roselle seed as soon as I thought the danger of frost was over. It was very thrifty, but did not bloom until the frost came, which killed it. It is a very pretty plant. I was disappointed at its not blooming earlier so as to mature the fruit.

Guill Bros., Chico, Butte County.—Roselle grew six feet, but did not make pods, as the frost caught it.

W. C. Bradford, Arbuckle, Colusa County.—I planted the Roselle much too thick, and I think watered it too much. It grew four feet high, a dense mat, but did not form seed-pods until too late to mature most of them.

M. Wambold, Lakeport, Lake County.—The Roselle grew very well, some three feet in height, branching very freely. The pods did not seem to form until quite late. When ready for picking, we distributed them among friends for trial. All pronounce it fine for jelly.

A. C. Noyes, Sonoma, Sonoma County.—The Roselle came up, but the cold killed it, and I fear it will only do for the very warm part of the State.

F. G. Smith, Skaggs, Sonoma County.—Roselle did not do well.

Ira W. Adams, Calistoga, Napa County.—The Roselle stands more drought than anything I ever raised; the bush Lima beans comes next. I am satisfied this climate is too cool, at night at least, for the successful growth of Roselle. I raised seventy-five plants, one of them nearly three feet in height with laterals eighteen inches long, with ten large pods and many small ones that did not mature. There were more blossoms when the frost came in October than at any other time in the season. I got only one and a half pounds of pods, from which my wife made a most excellent jelly. I think the Roselle would be a success where the seasons are long and hot and where the Lima bean grows to perfection.

Richard E. Meldon, Winters, Yolo County.—I have some fine plants and shall get a good crop of pods. I planted them out in very rich soil and watered them in very dry weather. The seeds ought to be planted in pots and set out as soon as the weather is warm, as Roselle requires a long season to mature.

R. S. Egbert & Sons, Rio Vista, Solano County.—Roselle on sandy soil was well irrigated and produced a great abundance of fruit, which did not mature until the early part of November. The jelly made from the green pods was not nearly so acid as currant jelly. Each plant sent out six or more lateral branches, each of which branched several times, bearing six or eight pods. The plant was highly ornamental.

F. F. Kennedy, Elk Grove, Sacramento County.—The Roselle made a rank growth, as many as a dozen blossoms on one stalk; but as to the jelly produced I cannot say that we cared for it.

Mrs. L. Miller, Elk Grove, Sacramento County.—The Roselle did remarkably well. Made some fine jelly from the pods.

L. L. Guss, Brentwood, Contra Costa County.—Roselle yielded about four hundred pods to the plant, and makes a good jelly.

T. E. Rice, Livermore, Alameda County.—The Roselle was watered but once to give the seeds a start. The plants all sent out lateral branches and have produced a great number of pods. The ripe pods were picked off several times, and the plants are still

loaded with pods in all stages of growth. The other day I counted one hundred and twenty pods on one plant, and I think they will average about one hundred. We like the jelly very much. All we have made has a very decided raspberry flavor.

Isadore Lecureuil, Santa Cruz, Santa Cruz County.—Roselle is a complete failure here either in poor or good soil, or dry or moist ground.

J. J. Bamber, Skyland, Santa Cruz County.—The Roselle got caught by the frost before it matured. It seems a very slow-growing plant up here.

Kate Millikan, Santa Clara, Santa Clara County.—The Roselle was planted in a soil as dry as powder, and germinated immediately as soon as they were irrigated. They grew and branched beautifully, but bloomed so late I had only a double handful of pods—no ripe seeds whatever. But these pods made jelly of a flavor and beauty truly surprising. I consider it a most valuable acquisition to the many varieties of plants disseminated by you.

C. P. Fairfield, Campbell, Santa Clara County.—The Roselle seed were slow to germinate. From plants irrigated once a week I gathered a large number of seed-pods, and used the whole pod in making the jelly. The severe early frosts this fall hardly allowed the remaining pods to ripen for seed. The jelly is an excellent substitute for cranberry jelly—a delicious jelly.

James C. Moody, Alma, Santa Clara County.—We have had poor success with Roselle both this year and last. This year we have planted twice; the first planting came up all right, but died when the plants were about two inches high. The second planting is doing the same. It may have been the frost.

E. A. Edwards, Hollister, San Benito County.—The Roselle is the greatest success of all. It was planted within six or eight feet of a small irrigating ditch, and made a wonderful growth, one single plant producing nearly three pounds of seed-pods. Its jelly, as tested by several parties, was pronounced *excellent*.

J. B. Swan, Hollister, San Benito County.—The Roselle made good growth.

G. F. Donkin, Grayson, Stanislaus County.—My Roselle is a puzzle to me, as it is so high and no pods have appeared upon it. It is six months old.

H. L. Howe, Oakdale, Stanislaus County.—Roselle grew to perfection, and I am delighted with it.

V. Roberts, Alcalde, Fresno County.—Roselle was planted April 10, 1897. I sowed it in two places, and it came up and grew well. One plot I watered more than the other. The plants of the less watered plot grew about three feet high and had more pods than those of the other. The plants of the well-watered plot grew five or six feet high, but did not fruit so well. Nevertheless, Roselle requires some water to make them bear, but not too much. But I should say that any one who can raise grapes had better not lose his time in raising the Roselle, because the grape makes about as good jelly and the grapevines are easier to cultivate.

E. A. Stillman, Mendota, Fresno County.—The Roselle grew luxuriantly all summer, reaching a height of three feet, but did not blossom. The soil is adobe, and of course the summers are exceedingly hot and dry.

Alfred R. Pearson, Clifton, Fresno County.—Roselle started growth very late. At the end of summer it began to grow, and was about eight feet high, with many branches and lots of flowering buds just coming out, when winter set in and killed it.

E. H. Whiting, Warthan, Fresno County.—The Roselle vines grew well, but did not begin to bloom until November and were caught by the frosts.

Wm. Muth-Rasmussen, Independence, Inyo County.—Roselle was irrigated and grew two to four feet high. It had some flower buds, but not a single flower. It is evidently not adapted to this locality.

G. W. Ballard, Travers, Tulare County.—Roselle was sown too late to bear, but made a fine growth. It had no water after July 1st, but grew right on until the frost took it. It was about four feet high.

Edwin Taylor, Parkfield, Monterey County.—Roselle was planted April 16, 1897. The same has stalks now (October 1st) three feet in length and looks well, but as yet has failed to produce a flower or pod. Perhaps it is due to the altitude, some three thousand feet above sea-level.

F. M. Cannahan, Metz, Monterey County.—The Roselle was full of pods. My wife thinks it is fine.

C. D. Guilford, Creston, San Luis Obispo County.—Roselle has failed two years in succession.

F. H. Preston, San Luis Obispo, San Luis Obispo County.—The plant grew well, and is pretty and interesting.

C. P. Mathison, Guadalupe, Santa Barbara County.—Roselle lived during the summer, but they were small stunted plants and died in the fall without making any seeds. They were planted on rich sandy loam that raised a big crop of potatoes. The land is slightly alkali, and our climate is cold, foggy, and windy. I would like to try it again on different soil and in a sheltered locality.

Leslie E. Conklin, Montecito, Santa Barbara County.—The Roselle made a very satisfactory growth. The unirrigated plants grew to about fifteen inches high and produced from three to five pods. The irrigated plants would all measure three feet, and on one plant I counted eighty-three pods. From two quarts of the pods we made one quart of most delicious jelly. The plants attract considerable attention, and all who have tasted the jelly pronounce it extra.

D. M. Dimmick, Carpenteria, Santa Barbara County.—Roselle makes a much better growth than I anticipated from the description in your bulletin. It is a very valuable plant for jelly. Nothing with which I am acquainted makes a better flavored jelly.

S. B. Bagnall, Simi, Ventura County.—I think Roselle is the most valuable acquisition of recent years to the kitchen garden. I planted about half the packet of seed in a rather dry sandy loam, giving good cultivation but no water, and have enough of the pods to supply the neighborhood with material for jelly. Many of the plants attained a height of four feet and a diameter fully as great, bearing upward of a hundred branches all loaded with pods. The jelly made from it is of most beautiful color and excellent quality. It is very easily made, and all who have tried it are enthusiastic in their praises. I planted the seed in the open ground about April 15th. It was long coming up and grew very slowly until the weather became hot, when its growth became rapid. The soil on which it grew is a high and dry mesa, having no underground supply of moisture. Our valley is about twenty-five miles from the sea, and considered very hot and dry by residents of the coast region.

A. W. Hall, East Highland, San Bernardino County.—The Roselle makes a fine exhibit, and I have a row one hundred aud fifty feet long. It makes a fine soup, equal to Okra of Kentucky.

P. F. Bachus, Verdugo, Los Angeles County.—The Roselle was planted on the 10th of March, 1898, in beds. When about six inches high, I transplanted it into black adobe, where I find it grows best, the pods being of a darker red and larger. Transplant it as you would the tomato, except that in very warm weather it should be watered about twenty-four hours after being planted. The fruit began to ripen about the first of August and bore until the last of November. The plants were watered twice, and responded readily to the water. Roselle grows about four by four feet, but if watered more it would grow much larger.

E. H. Ashley, Rivera, Los Angeles County.—I sowed the Roselle seeds in the ground on May 31st. The plants have made a wonderful growth, the main stem growing five to six feet tall. The stems were thickly set with fruit. From the husks, including the mature seed-pods, we have made excellent jelly having a beautifully clear ruby color. The seed ripens very slowly, having at present obtained but little. Another year I shall plant earlier by starting seeds in a hot-bed, as in raising eggplants, of which I grow a good many. Have sold and used about fifty pounds of the fruit at present, and every one who has seen it and tasted the jelly is highly pleased with it. I believe it will pay to grow, and next year I hope to have plenty to sell. The plants have been grown on rich sediment soil, and have been irrigated twice—about July and August. It seems very susceptible to cold, as during the last two or three weeks of December I lost nearly all my plants through the stems and roots decaying in parts, owing no doubt to the soil being too cold and moist since the rains.

J. J. Rivers, Santa Monica, Los Angeles County.—Santa Monica weather is too breezy for Roselle.

J. J. Hopper, Los Angeles.—I planted twenty feet square with the Roselle seed, with rows eight inches apart, and had three pickings from it and a total of one hundred pounds, which brought at wholesale six cents per pound. I irrigated it the same as I did the rest of my garden, once in ten days, and found the pod very large and perfect—the best of its kind grown in this part of the country. The soil is a sandy one. I think the plant improves by a little irrigation.

Edward Lester, Pasadena, Los Angeles County.—We were much pleased with the Roselle, which more than answered our expectations from the small number of plants set out. The jelly is delicious and of a most agreeable acid flavor. We shall grow it very much more largely this year. Apart from this desirable feature, the plant is an acquisition both as to bloom and foliage.

Joseph Thorndike, Pasadena, Los Angeles County.—Roselle was planted in very warm sandy soil on April 23d, and irrigated three times. The plants grew from three to six feet high, and where not too much crowded, branched near the ground into a bush four feet in diameter. Fruit grew all along the stem and on each branch. It makes very satisfactory jelly, and also a syrup for a drink.

Agnes Shorteng, South Pasadena, Los Angeles County.—We cannot speak too highly of Roselle as the coming jelly plant of California. Every one is asking me for seed.

C. A. Smith, Hollywood, Los Angeles County.—The Roselle did well planted in heavy black loam, and grew about five feet high and blossomed well. Fruit makes choice jelly.

F. J. Matts, Gardena, Los Angeles County.—Roselle was unirrigated, and did not mature.

W. A. Butterworth, South Pasadena, Los Angeles County.—The Roselle is a great success.

G. W. Mack, Westminster, Orange County.—The Roselle did the best of all, the plants showing several days before turnips that were planted at the same time. Almost every seed sprouted; the plants attained a height of from four to six feet, and branched freely. Some of the main stems had as many as eleven pods; there would have been more had the frost not stopped their growth.

John N. Glenn, Valle Vista, Riverside County.—The Roselle grew to a height of about five feet, and produced a good crop of pods. Although every one in this vicinity has plenty of fruit for jelly-making, they were all used. I think it would be especially valuable in localities where there is not much fruit raised. It stood the heat of this valley quite well, with only a moderate amount of water.

U. G. Abell, Escondido, San Diego County.—The Roselle made a bushy growth similar to cotton, attaining a height of fifteen inches, and having from three to eight pods on each branch. The ground was very dry, but rich. I did not irrigate. My wife ridiculed the idea of making jelly out of the husks, but when they were ripe she tried them, and was very agreeably surprised. To quote her own words, "It makes the finest jelly I ever saw, nicer than guava." Judging by this year's experience, I think it is a grand success.

Mrs. Denver O. Lamb, Fallbrook, San Diego County.—The Roselle I planted in a moist place, which I found entirely unsuited to the plant. The plants were long in starting, but when the weather got warm they grew into immense bushes, bloomed very sparingly, and only set a few little pods.

Mrs. S. J. Martin, La Costa, San Diego County.—One plant of Roselle had seed-pods on and I made a teacupful of fair jelly. Last year it was too dry for it to grow with us.

Miss Louise Schein, E. Bridgeport, Conn.—I sowed the Roselle seeds about May 12th, but the cold and rainy season killed off one fourth of the plants when they were two inches high, though most of them grew to that height. The remaining plants did not grow well until July, when the very hot weather set in; then they grew well until the middle of September. The plants were four and one fourth feet high, with quite a number of branches and had an average of eight buds. They began to set buds the 20th of September. We had several heavy frosts about two weeks later, which destroyed the plants before they could even blossom.

Mary A. Corson, Redmoon, Oklahoma.—The Roselle, on account of the lateness of the season, did not come to perfection, still it was far enough advanced to make some jelly of the pods, which we think is good.

PLANTS FOR GREEN-MANURING.

We are still pursuing our efforts to secure a leguminous plant which will prove satisfactory for green-manuring in California. As explained in earlier publications of the Station, it is necessary to have a plant which will make a heavy growth during the winter months, so that it can be plowed-in early in the spring, and the ground put in shape for the thorough surface pulverization which largely prevents evaporation of moisture during our long, dry summer. For this reason we cannot use many plants which are used for green-manuring in humid climates. Crimson clover, cow peas, etc., do not make good winter growth. The common "bur clover" (*Medicago denticulata*) and its near relative "snail clover" (*M. turbinata*) are proving very satisfactory in some parts of the State, and the "Canadian field pea" has been quite widely used in some of the southern citrus orchards, and the "hairy vetch" (*Vicia villosa*) gives promise to be of value. Experiments are also in progress with the native lupins, which may yield valuable results, as described in Bulletin 124 of this Station and reprinted in this report. The following are reports of progress with several plants:

FENUGREEK (*Trigonella fœnum græcum*).

This is an old plant of the Mediterranean region. It is of the clover tribe: an annual which, under favorable conditions, produces a heavy weight of stem and foliage. It is used in the old countries for hay-flavoring; the seed also has aromatic quality and special use in veterinary medicine. But it is rather for its possibilities in the green-manure line that we undertook its trial, and this use was suggested by the report of the Director of the Botanical Service of Algeria and Tunis for 1896, which mentioned a trial of Fenugreek sown in the autumn which produced by the first of the following March a weight of 25 tons per acre of green forage. The part of the field which was allowed to ripen produced about 1,400 pounds of seed per acre. Since our experiments began, later information of the value of the plant in Algeria has been received. The following is an extract from the "Bulletin Agricole" of Algeria and Tunis, October 1, 1899:

This legume, which is commonly cultivated in the Mediterranean region, is well adapted to the littoral climate of Algeria. An area of at least a hectare (2.471 acres) has been under cultivation in Fenugreek for four years, at the Agricultural Experiment Station in Algeria; the returns have always been considerable and have varied from 45 to 80 tons of the green plant to the hectare (18.21 to 32.37 tons per acre). The weight of 60 tons per hectare (24.26 tons per acre) is frequently obtained, and 80 tons was obtained in 1899 by means of two cuttings, the one in January used as green forage, the other in March.

Fenugreek will, during winter, furnish abundance of forage for stock, who eat it greedily; however, it should not be fed to beef cattle, at least not alone, as it shows a tendency to give their flesh a very disagreeable flavor.

Fenugreek should be sown before the rains, at the rate of 15 to 20 kilog. to the hectare (13.38 to 16.08 pounds to the acre). It is very easy to obtain this seed in Algeria, the yield of seed in good soils being about 15 quintaux to the hectare (89.21 pounds per acre).

Fenugreek greatly improves the soil, and wheat grows very well after this legume, even when it has been cut for forage. In vineyards, Fenugreek could be used to advantage conjointly with Lupins. It will give the best returns in soils manured with potash salts, phosphates, and lime.

In tobacco culture, a mixed crop of Fenugreek and Egyptian Bean (*Faba vulgaris* var.) is found to be a green-manure of the first quality, greatly increasing the fertility of the soil. Dr. Trabut reports as the result of four years' experiments in Algeria, that it not only increases the yield of tobacco, but also augments its fundamental quality, its combustibility. In thoroughly prepared soils, with the aid of a potash manure free from chlorine, and after a preceding crop of Fenugreek plowed-in in winter, it is possible to obtain consecutive crops of tobacco, increasing both in quality and quantity.

The local trials in California seem to indicate that the plant endures as low temperatures as it is likely to encounter in most valley situations, but it must have adequate moisture to make a good winter growth. For this reason it has not had a fair trial during the last two years of short and ill-timed rainfall, and must be further grown to determine its behavior in a normal winter season. Its character as shown abroad seems to warrant further trial in this State. The following are reports from California growers:

C. C. Spear, Waddington, Humboldt County.—I think I have given the Fenugreek a good trial. I sowed two small papers last season in rows, and cultivated it the same as I did my beets, and gathered two hundred pounds of seeds from it. It grew three times as high as alfalfa, which was planted ten days sooner. When ripe, I cut and thrashed it late, and soon after we had some heavy frosts, but it did not seem to check the growth of the Fenugreek seeds. They came up and made a rapid growth all winter. I also sowed one hundred pounds with oats a few days before the heavy frost in January, and the ground was frozen hard for three or four days and nights, and part of the time covered with snow. Nearly half of the seeds were washed on top of the ground and some of them sprouted, but it has come out all right and is now growing fine, so I think it will stand almost any kind of weather.

Wm. E. Whitmore, Whitmore, Shasta County.—Fenugreek was planted in the spring. It got about six inches high, and was irrigated too. Was disgusted with it.

L. C. Gage, Lincoln, Placer County.—Fenugreek grew to the height of about six inches seeded and died. I could not find any tubercles on the roots. I think the seed should be inoculated before it is sent out.

Charles Strehlow, Healdsburg, Sonoma County.—Fenugreek grew about fourteen inches high, but died out before all the seed was ripe.

R. Robertson, Yountville, Napa County.—Fenugreek made only a little growth. Frost did not hurt it any, but still it did not amount to much.

Lewis Stinsen, Napa, Napa County.—Fenugreek is very fine on dry land.

Paul Le Boyd, Elk Grove, Sacramento County.—I planted Fenugreek February 3d. The first leaves came up six days later. It withstood several severe frosts, but made little growth and died of drought (in May) when about two inches high and having six leaves. It was planted on red loam without a fertilizer. Wheat on the same land made a small crop.

T. E. Rice, Livermore, Alameda County.—A packet of Fenugreek was sown, but owing to the drought it did not make a very rank growth. The plants averaged about a foot in height and bore quite a heavy crop of seed. Most of the seed was gathered, but a considerable amount shelled out and was left on the ground. It started to grow with the first rain, but has not made much progress as yet; some of it seems to be injured a little by the frost, but it may pull through.

G. W. Ballard, Traver, Tulare County.—The Fenugreek was sown too late. It came up well, but made no growth.

C. D. Guilford, Creston, San Luis Obispo County.—Fenugreek, planted in loam soil, matured seed-pods six to seven inches in length.

Edward Lester, Pasadena, Los Angeles County.—The Fenugreek I believe is likely to be of great service as a green food for poultry, in addition to its usefulness as a spice for cattle-fodder. When a number of fowls are kept near to the city and in close quarters, and the daily supply of green food is a necessity, it is a very useful and desirable food for the hand cutter, mixed with other grass or vegetables from the household.

M. Jameson, Corona, Riverside County.—The Fenugreek seed sent me last year came up when we had our hard freeze, and was not affected. It, however, made a slim growth, on account of drought. The prospect is little better the present season.

Jacob Veitinger, Jamul, San Diego County.—I have harvested four pounds of Fenugreek seed. The pods grew six and eight inches long. They were quite hard to open, and after working at it for a certain time I had to jump up—it made me vomit; and so several times. The thought came to me to put them in the mill, stem and pods. I set the mill wide while I was grinding, and put a cloth around my nose and mouth to prevent inhaling the dust. When I cleaned the seed in the wind, my chickens picked up some and it physicked them.

THE HAIRY VETCH (*Vicia villosa*).

This annual leguminous plant, native of western Asia, promises to be one of the best winter-growing plants of its class, both for forage and green-manure purposes, in California. Besides the hardiness against frost, which gives it such standing, it also has marked drought resistance, which will make it valuable for summer growth on moderately dry lands. Its winter growth is best secured upon rather light, well-drained soils, for it does not thrive on cold, wet soil. Summer growth is, however, attained on heavy retentive soils, which would not suit it in the winter in regions of heavy rainfall. On good orchard land its winter growth is suitable for early plowing-under, and on light plains soil and hillsides its growth, especially when sown with oats, will make fine winter forage. We shall promote further trial of the plant for all these ends.

On rather heavy soil in Berkeley, the seed sown February 24, 1899, sprouted March 7th; the plant bloomed June 3d, and was cut for a seed crop July 24th. The plant still showed much verdure, and the vines were five to six feet in length. The product of green vine, etc., was at the rate of 17½ tons to the acre, which cured to a weight of about 8 tons. Horses and cows ate the plant readily, both green and as hay. If grown with oats, it is more readily harvested, as, supported by the

oats, it largely forsakes its prostrate growth, which makes it difficult to handle with a mower, either for the hay stack or the silo. The following are the results of local trials:

Louis Hardt, Grass Valley, Nevada County.—The Hairy Vetch did very well when it got a little water.

J. H. Dobbins, Colfax, Placer County.—Hairy Vetch did very well; it made a good growth of two feet, and seeded well. Some was still green in October.

F. Segsworth, Ben Lomond, Santa Cruz County.—The Hairy Vetch (*Vicia villosa*) grew to a height of two and a half to three feet, and remained green through the summer. After it has established a root it will stand almost any amount of drought, and still remain green and make some growth. With a moderate amount of moisture it will make a tremendous growth in a few weeks, and for green-manure I do not know what could be better. Sown in the fall as early as possible it will get well rooted before the cold weather stops its growth (as it does not make much growth in winter), and as soon as spring opens it will start out and make a rank mass of herbage by April, when it may be turned under for manure or cut and fed to cows, as it is excellent as a milk-producer. It will then grow up again and remain green and grow all summer long without irrigation, though, of course, it will not make much growth after the soil becomes dry. Hairy Vetch will grow and thrive on soil that is too poor and dry for corn, and as so much of our mountain land is of that character it would seem that the plant should be more widely known than it is. I would not be without it now, as I have experimented with it sufficiently to know its good qualities. It makes the best green food for poultry I ever saw, as the stem is soft and juicy, and when cut fine the fowls will eat every bit of it.

C. D. Guilford, Creston, San Luis Obispo County.—Hairy Vetch grew well, covering the ground, but did not mature seed.

Edward Lester, Pasadena, Los Angeles County.—I tried a small quantity of the Hairy Vetch last year, and am quite pleased with it as a promising fodder plant. It had practically no water, and was fresh, green, and blooming when all other unwatered things were dead. It seems well adapted to this locality.

FORAGE PLANTS.

In addition to the foregoing, which have standing both for green-manuring and for forage, there are others which must be rated solely upon forage value. Prominent among these are the "saltbushes," which are quite fully considered in Bulletin 125 of this Station. As they are involved in this distribution, in addition to the testimony of their adaptations as published in our report of 1896–7, it is desirable to place some facts upon record.

THE SALTBUSHES (*Atriplex* sp.).

The following species have been included in our seed distribution:

AUSTRALIAN SALTBUSH (*Atriplex semibaccata*).—The value of this plant has been demonstrated beyond question for lands too alkaline for the growth of ordinary forage plants. Our first general distribution of the seed was in 1895, and yet so rapid has the fame of the plant extended that thousands of acres of waste alkali land have already been made valuable by its growth. The seed came upon the market in 1897, and can be supplied by any California seedman. We still, however, have an overwhelming demand for small trial packages from all parts of the world.

SALTBUSH No. 2 (*Atriplex leptocarpa*).—This East Australian species was first distributed from this Station four years ago. It has shown special adaptation to situations where the summer heat is less than in the upper San Joaquin Valley. At Santa Monica and on heavier lands near Pomona it has made better growth than the *semibaccata* and is apparently quite as good for stock-feeding.

MEALY SALTBUSH (*Atriplex halimoides*).—This species promises to surpass the *semibaccata* on dry lands and gives indications of being valuable on so-called desert situations. It is native to the central desert regions of Australia. It makes very rapid growth and begins to bear seed in three months after sowing. If cut or pastured down, it forms a very compact mass of soft new growth very unlike that of *semibaccata*. The plant is covered with a heavy whitish, scaly dust which seems to justify a popular name as "mealy saltbush." It makes a taller growth than *semibaccata*.

BLADDERY SALTBUSH (*Atriplex vesicaria*).—This species is easily recognized by the profusion of small bladder-like vessels which occur amidst the foliage and enclose the seed. Otherwise it much resembles the *halimoides* in growth and appearance.

Fuller characterization of these species and others is given in our Bulletin 125, to which allusion has been made. The following are the latest reports of voluntary experimenters:

Mr. Duvall, Datura, Lassen County.—The package of Australian Saltbush was sowed in June and grew two feet in diameter. I gathered one quart of seed from it. Although it was sown so late, it stood the frost better than alfalfa, for when the frost left in October it was still green, while the alfalfa had withered. It stood the severe winter of 1897–8 well, and is still growing. It was sowed in alkali soil.

W. C. Cockrill, Latrobe, El Dorado County.—The Saltbush does well in this locality. I planted it in boxes, and transplanted it in April on very dry ground. It made a growth of about two feet without any irrigation. In August the cattle broke in and ate it all off, but it commenced to grow again and remained green all fall and is green yet (December 22d).

R. Setterly, Spenceville, Nevada County.—I received some Australian Saltbush seed last year. The few plants that came up grew all summer, but were killed during the winter by the frost.

J. H. Dobbins, Colfax, Placer County.—Australian Saltbush and Saltbush No. 2 are a success. They attained a growth of about eighteen inches under adverse conditions of late sowing, beating rains, poor soil, no alkali, and drought. My stock seem fond of it, and as fast as I can get it to grow I will plant all I can, but it is hard to start here. The Bladdery and Mealy Saltbushes failed entirely in open ground, but I have some ready to start out this fall, so I can tell more about it next year.

Mrs. V. B. Taylor, Manton, Tehama County.—The Mealy Saltbush did not grow well, as the season was too dry.

W. H. Cushman, Millsaps, Glenn County.—The Mealy Saltbush made fair growth and has a good many seed.

A. J. Butter, Colusa, Colusa County.—Saltbush seeds are doing well. The plants received absolutely no water for four months of the driest part of last season, but continue to grow.

W. C. Bradford, Arbuckle, Colusa County.—The Australian Saltbush grew from a few inches to three feet in diameter on hard, dry clay land where even weeds did not grow, and they volunteered from self-sown seed in the hard road and walk, growing slowly all summer. The Mealy Saltbush grew equally well under the same conditions.

Jasper Kolpien, Grimes, Colusa County.—In 1885 I got some Australian Saltbush from you. It grows well here, and about every farmer is sowing some this year. A great many tried it last year, and they all praise it.

Fred Wilkendorf, Woodland, Yolo County.—The Saltbush made a tolerably fair growth. When the branches were about eight inches long I cut them off and fed them to the stock. I found that cattle and sheep relished the Saltbush, and chickens were ravenous for the leaves, always picking the stem bare when I had some for them. When the stems were cut off other shoots would strike out from lower down; thus the plants kept thrifty all summer. I did not make my experiments in alkali soil, but in a sort of red gravel.

John Stix, Napa, Napa County.—The Australian Saltbush and the Modiola both did well, considering the extremely dry weather, especially the Saltbush. There are a few plants growing now without protection. They are liked by stock.

H. Kuhirt, Atlas, Napa County.—Of the Saltbush I had last year only the common kind did well. At first the cow would not eat it, but she found out.

T. J. True, Forestville, Sonoma County.—Australian and Mealy Saltbush were sown in April on poor soil. I did not observe them until late in October, when they had grown four or five inches. They kept green and grew some during the winter. Stock like the plants fairly well. Both kinds were green and made some growth during the following summer, the driest year we ever had. They pull up by the roots very easily, but they were green and grew a little when everything else was dried up. I think they are worthy of more trial, especially on poor soil.

Geo. H. Suhren, Collinsville, Solano County.—The Australian Saltbush makes a big growth here.

T. E. Rice, Livermore, Alameda County.—I have grown the Australian Saltbush for two years, and am well pleased with it. It seems to stand the drought better than the Mealy Saltbush which I tried.

Robert Hastie, Clayton, Contra Costa County.—Australian Saltbush did not do well the first year, but it kept green all summer and made some seed, from which it grew finely the second year.

L. L. Guss, Brentwood, Contra Costa County.—Chickens are very fond of Saltbush, also of Modiola.

J. M. Pollock, Gilroy, Santa Clara County.—The Saltbush and Modiola I planted on January 26, 1897, in both cultivated and uncultivated ground, on adobe and on red land. I covered some with earth and left some uncovered, but in no single instance did it grow. I therefore conclude that this district is unsuited to these forage plants.

G. F. Donkins, Grayson, Stanislaus County.—Saltbush is doing well, and I think it is a success here. My chickens, turkeys, horses, and cow all like it. The turkeys fly into my garden, and while there is plenty other feed they will invariably go to the Saltbushes and eat as though it were cabbage. It is excellent feed for cattle, also. I have no Saltbush grown without irrigation, as it was too dry here for the seed to sprout.

Wallace Morgan, Miramonti, Kern County.—We have no trouble in making the Saltbush grow if we give it a little water. It will do nothing with only the rain, which is very scant here. But the same amount of water on the poorest land here will bring up some native plant, and the chance is good that it will be better than Saltbush. A number of people in this vicinity have planted more or less Saltbush, and so far as I can hear none of them know any good of it.

H. G. Clinton, Gertrude, Madera County.—Some Mealy Saltbush that was planted in an old hot-bed grew up to the sash before spring. As water was scarce, it had none all the year, but kept green. It faced the south and the air was very hot.

C. D. Guilford, Creston, San Luis Obispo County.—Bladdery Saltbush at the middle of October is about one and a half feet high, with seed matured and the bush still green. The *semibaccata* does well.

H. H. Gird, Bonsall, San Diego County.—The Saltbush (*semibaccata*) is a success. It is a fair feed, and I am not averse to its extending itself over good land, which it is not backward in doing.

J. S. Irgens, Jamul, San Diego County.—I have tried some of the Saltbush. It does well here. Horses, cattle, chickens, and turkeys like it very much.

Mary A. Corson, Redmoon, Roger Mills County, Oklahoma.—The Saltbush did well, but will not stand the winter in this section.

JERUSALEM ARTICHOKES (*Helianthus tuberosus*).

This field and garden esculent has been so often commented upon in our reports that further remark is unnecessary. The following reports from growers present the latest phases of agricultural opinion as to value and adaptation of the plant:

Claud D. Tribble, Lotus, El Dorado County.—White Jerusalem Artichokes were planted on March 15th. I never worked them at all, and the other day dug them and we got about two gallons. I fully believe if they had been attended to properly there would have been five bushels of them from two hills, in clayey soil.

Chas. Koerner, Willits, Mendocino County.—The Jerusalem Artichokes have done splendidly, and I expect to harvest quite a little from them this year. I am raising them to be put in a place for hogs next season, and it looks good from a small start.

Peter Bonta, Miller, Mendocino County.—Jerusalem Artichokes did splendidly.

A. J. Sutter, Colusa, Colusa County.—Red Brazilian Artichokes, in spite of the dry season, made excellent growth and greatly multiplied roots.

W. C. Bradford, Arbuckle, Colusa County.—The White Jerusalem Artichoke yielded a heavy growth, but the Red Artichoke had a light yield.

Chas. F. Street, San Mateo, San Mateo County.—Artichokes, Red and White: Contrary to my expectations, the French White proved a trifle the heaviest cropper, but both made an excellent showing. I got about one hundred pounds altogether. Quite a lot were small tubers, which no doubt would have increased greatly in weight had I been able to irrigate a little more in the driest part of the season.

R. S. Egbert & Sons, Rio Vista, Solano County.—The Jerusalem Artichokes in a sandy soil were irrigated and produced heavily—three gallons of roots to one plant. The roots when cooked were tender and of fine flavor.

John Stix, Napa, Napa County.—White French and Red Brazilian Artichokes were planted on land prepared for potatoes, and received common cultivation. They grew four to five feet high, and were dug late in October. I got from both samples three fourths of a barley sack. They yield better than potatoes. In point of production the Red Brazilian did the better by far.

H. E. Brown, St. Helena, Napa County.—Jerusalem Artichokes of both kinds grew finely.

S. F. Thorn, Glenwood, Santa Cruz County.—The Jerusalem Artichokes climbed to the sky. They must have grown thirteen feet high, and last week when we gathered them from the five little nubbins that I planted, there were nearly a peck to each. They multiplied wonderfully.

James More, Campbell, Santa Clara County.—White Jerusalem Artichokes planted on high ground did well. I think farmers in mountainous districts on newly cleared ground will find a new feed for cattle in them, as it was under such conditions I tried mine.

Hal G. Osburn, Los Gatos, Santa Clara County.—The Artichokes came up splendidly and are very prolific, but as a vegetable or in any form we have not been able to develop a liking for them.

D. W. Miller, San José, Santa Clara County.—The White Artichokes have done splendidly. I must have over one hundred pounds from the one pound of seed.

H. L. Howe, Oakdale, Stanislaus County.—The Jerusalem Artichokes planted January 22d yielded abundantly. Cattle, sheep, and fowls eat them with great relish.

V. Roberts, Alcalde, Fresno County.—White French Jerusalem Artichokes were planted February 23d in sandy loam. I cut the bulbs as I do potatoes for planting. I watered them during the summer, and they did very well. I think they are a good crop to raise for hogs, also for table use.

E. H. Walker, Hanford, Kings County.—The Jerusalem Artichokes I had from you yielded enormously, and are of superior excellence.

F. M. Cannahan, Metz, Monterey County.—Artichokes are splendid. I dug them the other day. The gophers got the most of them before I knew they were at work on them. Out of eight hills where the gophers had not been I got almost two barley sacks full.

H. H. Gird, Bonsall, San Diego County.—The French Artichoke raised beautiful large tubers, and is a vigorous grower here.

JERSEY KALE.

Reports from those who have grown this plant from our seed are emphatic in praise of it as a summer and fall green feed, chiefly for poultry. It requires moist land, but where even a small area of ground can be irrigated from a well or other small water-supply, the weight of green growth is probably greater than can be secured with any other plant with the same amount of water. It withstands both cold and heat better than any other cultivated member of the cabbage family, and the old stems bear good crops of leaves for several years where the ground does not freeze in winter. The leaves are often twenty-eight inches in length and eighteen inches in breadth, and when plucked from the stem are quickly replaced. The following are the latest reports from our correspondents:

G. H. Chad, Scotia, Humboldt County.—Jersey Kale grew two feet high, and looks very promising.

W. C. Bradford, Arbuckle, Colusa County.—Jersey Kale does well. Some lived all summer without water, though it did not grow until now. That which I watered was much damaged by bugs.

George B. Pearce, Jr., Paradise, Butte County.—Jersey Kale did nicely until those large black bugs with red spots on them, which kill out the cabbage and turnips, found them, when they soon had them most ruined. About that time some small chickens that had the run of the garden commenced eating the bugs, as did also some small birds, and between them they cleaned the plants off. The Kale has done finely this fall and makes lots of feed for pigs and chickens. Hard frosts do not seem to hurt it.

Mrs. J. B. Hoyt, Bird's Landing, Solano County.—The Jersey Kale did well and has stood considerable cutting. It was planted in sandy soil.

Paul Le Boyd, Elk Grove, Sacramento County.—Jersey Kale made a tall growth, but the leaves were small and were not replaced when picked. It is far inferior to alfalfa for green feed.

F. F. Kennedy, Elk Grove, Sacramento County.—The Jersey Kale was a success. I plucked the leaves as they obtained a good size, and several stalks are still standing. Poultry are very fond of it.

John Stix, Napa, Napa County.—Jersey Kale yielded an abundance of green leaves right along. It does not seem to mind a light frost. One plant which is in the garden now looks like a palm and is six feet high.

Frank Owen, Monticello, Napa County.—The Jersey Kale did well upon thin soil, growing to a height of three feet. It is undoubtedly of considerable feeding value.

Karl H. Seamans, Ione, Amador County.—The Kale for this section is a splendid success, growing from three to five feet. It furnishes abundant green feed for fowls in summer and fall when the natural supply is brown and parched. It also yields a large supply of seeds, which, however, are difficult to retain, on account of the birds.

Charles F. Street, San Mateo, San Mateo County.—Jersey Kale has done well; it proved very valuable in providing a continuous supply of green leaves for birds, chickens, cows, etc. I have it now standing from four to six feet in height, promising an abundance of young shoots.

J. G. F. Eitel, Mountain Ranch, Calaveras County.—Jersey Kale is at present three feet high. The chickens never tire of it when mixed with bran and boiled. The plants have not yet blossomed.

J. C. Hansen, Campbell, Santa Clara County.—The Jersey Kale was sown late and did not do well at first, as the plant lice were bad on it; but it is doing excellently now, though it has not made so large a growth as the bulletin says it can grow. However, it is better than any other Kale we ever had. The chickens are very fond of it.

J. B. Swan, Hollister, San Benito County.—The Jersey Kale made an enormous growth, and is valuable as a green foliage plant for poultry on a small place, or for stock in larger quantities.

E. A. Edwards, Hollister, San Benito County.—The Jersey Kale is a decided success.

H. L. Howe, Oakdale, Stanislaus County.—Jersey Kale, planted March 27th, grows rapidly, and is doing well.

F. H. Preston, San Luis Obispo, San Luis Obispo County.—Jersey Kale, put in January 21st, has made a wonderful growth, and is a sight to behold. Some of the plants are six feet high. I consider it very useful for poultry.

C. A. Smith, Hollywood, Los Angeles County.—Jersey Kale did well. It grew from two and a half feet to six feet high. It is good feed for chickens and cows. The center of the stem cooks up, and has the flavor of cabbage.

F. J. Matts, Gardena, Los Angeles County.—Kale did well, and is all you claim for it. It is a valuable plant for poultry. It was irrigated.

John N. Glenn, Valle Vista, Riverside County.—My soil seemed not rich enough for Jersey Kale, but plants set out by some of my neighbors produced fine large leaves, that were eaten greedily by the poultry.

F. D. Waite, San Diego, San Diego County.—Shortly after transplanting the Jersey Kale I began to cut off the leaves to feed to the chickens. I found that the Kale produced more foliage feed than any other green stuff I have ever grown. I think four times as much as alfalfa. I have cut and fed the Kale until now (October), and although it is still growing some, its vitality appears to be exhausted. During this time it has never produced a seed.

William W. Dail, Jamul, San Diego County.—We find the Jersey Kale you sent us just the thing to raise for feed for this dry climate.

DRY LAND GRASSES.

Of the perennial grasses on trial for drought resistance and maintenance of life during the dry season, data given in previous reports cannot be materially modified. The following are later records of trials in various parts of the State, supplementary to data given in our report for 1897:

THE OAT GRASSES.

Wm. T. Williams, Grass Valley, Nevada County.—Tall Oat Grass seems to be a failure here, but I am unable to find the cause.

Guill Bros., Chico, Butte County.—Four years ago we received a sample of Tall Oat Grass, and have saved two crops of seed each season from the same patch. It is a fine grass for this locality. The Yellow Oat Grass did well for us, keeping green all summer.

E. A. Lucan, Cloverdale, Sonoma County.—White Tall Oat Grass made a poor growth.

T. E. Rice, Livermore, Alameda County.—Tall Oat Grass and Yellow Oat Grass grew to the height of twenty-four and sixteen inches, respectively. They promised a fine crop of seed, but a neighbor's cow broke through the fence one night and cleaned off both plots of grass, pulling most of it up, roots and all. Since the last rain the Yellow Oat is sending up shoots from the old roots, but the Tall Oat has not started yet. I think they will both be very valuable grasses for this section.

TEXAS BLUE GRASS.

G. H. Chad, Scotia, Humboldt County.—The Texas Blue Grass has spread over about ten feet square, and is growing very nicely. I am well pleased with it,

H. L. Howe, Oakdale, Stanislaus County.—The Texas Blue Grass roots set out January 11th have done well, but it grows slowly.

James C. Hayes, Porterville, Tulare County.—Texas Blue Grass did not do well, on account of the drought. I never watered any of it, but it grew some and stood the entire summer of 1898.

THE BROME GRASSES.

E. A. Lucan, Cloverdale, Sonoma County.—Awnless Brome Grass died out, and Schrader's Brome only made fair growth.

T. E. Rice, Livermore, Alameda County.—The Awnless Brome Grass just came up and then died out; it did not send up any seed stalks.

Lewis Stinsen, Napa, Napa County.—Awnless Brome Grass, Teff and Crab Grass are the best grasses for dry uplands. They grow fine.

T. E. Rice, Livermore, Alameda County.—Schrader's Brome Grass came up promptly and lost no time in going to seed. A few stalks grew to be five or six inches high, but most of it went to seed just as it came through the ground. A good many seeds are growing now while still attached to the old stock, or rather to the old root, as the lower ends of the seeds are still below the surface of the ground. I hope it will grow higher this year.

BUFFALO GRASS.

T. E. Rice, Livermore, Alameda County.—Most of the Buffalo Grass roots grew to the length of about a foot and sent out roots at the joints, but the ground was too hard and dry for them. Some of the grass kept green all the summer of 1898, and fresh shoots are coming up from roots now. I think any grass that had the courage to live through last season will prove to be a good thing in ordinary years.

James C. Hayes, Porterville, Tulare County.—Last year I set out some Buffalo Grass roots on dry, sandy land, with some alkali in the soil, but owing to the extreme drought of last year it did not do well.

GARDEN AND FIELD SEEDS.

Several garden and field plants have now been sufficiently tried to determine their leading characters and local values, as follows:

EDIBLE-POD PEA.

For this pea we are indebted to Mr. Edward Lester of Pasadena, who introduced it from England, where he had learned its value. In regions suited to it, it is a delicious vegetable cooked in the pod, which is entirely stringless. The plant is sturdy and grows about five feet in height, bearing a purple bloom. The pod is about four inches in length, much curled and semi-transparent. From seed sown in Berkeley February 25th the pods were ready for table use on May 14th.

Mrs. V. B. Taylor, Manton, Tehama County.—The Edible-Pod Pea grew well and bore very well, but I do not think it will ever be a popular table vegetable.

Claud D. Tribble, Lotus, El Dorado County.—Edible-Pod Pea seems to be too delicate for this season of north winds and reverses of climate. I do not believe it is adapted to our climate. My seeds were planted in rich, loose loamy soil, but the vines died.

Peter Bonta, Miller, Mendocino County.—The Edible-Pod Pea is fine in every respect.

T. G. Turner, Lower Lake, Lake County.—Edible-Pod Pea is a rank grower, but has very few pods, which are small.

J. J. Rivers, St. Helena, Napa County.—Edible-Pod Pea grew well, large, and prolific, but it is an unsatisfactory plant, except for green-pea soup. It is not an English production, but belongs to China.

John Stix, Napa, Napa County.—We had two crops of Edible-Pod Peas. It proved to be very productive; a hardy grower, and we like it very much.

Ira W. Adams, Calistoga, Napa County.—I have grown the Edible-Pod Pea for some years past. It is certainly a great acquisition, but takes a long time to come to maturity. I plant it here early in February, and by so doing raise it without irrigation.

R. S. Egbert & Sons, Rio Vista, Solano County.—Edible-Pod Pea was sheltered from the north wind and grew well, but as the sweetness is all in the pod it does not seem to be a desirable kind.

Charles F. Street, San Mateo, San Mateo County.—Edible-Pod Pea is a failure with me; it cannot survive the hot sun; it takes mildew freely. I notice the chickadees are very fond of the young pod, attacking nearly every one, while Carter's Michaelmas Pea, growing alongside, was scarcely touched. By the way, I consider the last named very valuable in this climate. It stands the drought remarkably well. It has well-filled pods, and is a fine table pea.

J. M. Pollock, Gilroy, Santa Clara County.—The Edible-Pod Pea grew luxuriantly and yielded a heavy crop.

James C. Moody, Alma, Santa Clara County.—We consider the Edible-Pod Pea a success. We like it very much.

C. P. Fairfield, Campbell, Santa Clara County.—We consider the Edible-Pod Pea an excellent *pod* pea. Some experience in gathering them is necessary, or one is likely to allow the pods to become too old and then they are stringy.

J. B. Swan, Hollister, San Benito County.—The Edible-Pod Pea did not make a very large growth. It was so dry that irrigation did not seem to help them.

Edwin Y. Taylor, Parkfield, Monterey County.—I have every reason to believe the Edible-Pod Pea will prove as hardy and prolific a bearer as the average sweet pea in this region.

V. Roberts, Alcalde, Fresno County.—The Edible-Pod Pea has large pods, is a good bearer, and promises to be a good pea for the table.

C. D. Guilford, Creston, San Luis Obispo County.—The Edible-Pod Pea grew three feet, with well-filled pods three inches long. The flavor is sweet, but I have others as good.

Leslie E. Conklin, Montecito, Santa Barbara County.—The Edible-Pod Pea, owing to the prevalence of high winds and the absence of late rains, did not do well. The vines became dry before the pods were fully developed.

Adolph Scharff, South Pasadena, Los Angeles County.—Edible-Pod Pea grew very satisfactorily, and bore a number of pods which proved a welcome addition to the table.

F. J. Matts, Gardena, Los Angeles County.—Edible-Pod Pea did not grow.

E. L. Chambers, Riverside, Riverside County.—The Edible-Pod Peas did well.

Wm. W. Dail, Jamul, San Diego County.—Those Edible-Pod Peas I think will do fully as well as any of the common peas. They are splendid to eat.

WASHINGTON MARKET CORN.

Seed of this variety was sent us by the United States Department of Agriculture. In vigor of growth, number of ears to the stalk, length and shapeliness of the ears, size and tenderness of kernel, it is the best we have ever grown under Berkeley conditions. The following reports show its standing throughout the State:

G. H. Chad, Scotia, Humboldt County.—The Washington Market Corn is very fine. The stalks grew about eight feet, but did not set very many ears. It was planted at the same time as Mammoth Evergreen, and matured the same time. The eating qualities of the two are about the same.

August Gossman, Philo, Mendocino County.—The Washington Market Corn grew first rate, with tall stalks and large ears, and was very sweet and tender.

J. E. Rutherford, Wyandotte, Butte County.—The Washington Market Corn did well planted on a red clay soil.

A. C. Noyes, Sonoma, Sonoma County.—The Washington Market Corn was very fine and of sweet flavor.

Ira W. Adams, Calistoga, Napa County.—The Washington Market Corn is a good variety for table use. I, however, think the *genuine* Stowell's Evergreen and Country Gentleman are its superior for sweetness.

R. S. Egbert & Sons, Rio Vista, Solano County.—Washington Market Corn, sown in the latter part of June in sandy soil, well irrigated and cultivated, produced two and often three ears to a stalk. The ears were large and full and the corn very sweet and tender. It matured early in September. Probably owing to its quick growth at this time of the year there were no worms. Early Coy, Mammoth Sugar, and Country Gentleman, grown under the same conditions, were all inferior to the Washington.

J. G. F. Eitel, Mountain Ranch, Calaveras County.—Washington Market Corn did very well. The ears were large, tender, and sweet.

Lewis Hardt, Grass Valley, Nevada County.—The Washington Market Corn was planted at two different times. The first lot was up about three inches when the frost came and killed considerable of it and nipped the ends of the remainder, but it came out all right and did very well. The second lot did finely and produced nice large ears of a first rate quality.

Charles F. Street, San Mateo, San Mateo County.—Washington Market Corn showed well, but not being able to supply the moisture necessary on this land I do not consider it had a fair show. There is no doubt of its being a profitable variety.

F. Segsworth, Ben Lomond, Santa Cruz County.—Washington Market Corn is very late here. Although planted in April it is not fit for use until September. However, it is of good quality and grows large.

J. J. Bamber, Skyland, Santa Cruz County.—The Washington Market Corn is, I think, a good late variety.

S. F. Thorn, Glenwood, Santa Cruz County.—The Washington Market Corn did fairly well, but is really no better, if equal to the Bucks County (Pa.) Sweet Corn, which I have had the past three years.

D. W. Miller, San José, Santa Clara County.—The Washington Market Corn is not a success, running more to stalk than to ear.

V. Roberts, Alcalde, Fresno County.—Washington Market Corn was planted April 10th. It came up and grew well from the start. I watered it through the summer. Although not so early as some corn when it is good for roasting ears, it stays soft and good for the table longer than any corn that I ever saw, and the ears grew as large as those of yellow corn. The only drawback I could see was that many of the ears were blasted. I think it takes considerable water.

E. H. Whiting, Warthan, Fresno County.—Washington Market Corn is excellent, with large sweet ears and an abundant yield.

Edwin Taylor, Parkfield, Monterey County.—Owing to the extreme drought this season the Washington Market Corn did not fill well on the ears, but I find it is a very nice variety for table use; it does not harden as quick as other varieties.

F. H. Preston, San Luis Obispo, San Luis Obispo County.—Washington Market Corn, planted April 28th, grew fast. The ears were of good size and well filled. I consider it a choice variety.

D. M. Dimmick, Carpenteria, Santa Barbara County.—Washington Market Corn is about the same season and quality as Stowell's Evergreen, but a stronger growing, better bearing, and a more showy variety. I think it is an improvement.

S. B. Bagnall, Simi, Ventura County.—Washington Market Corn was found in every way desirable—large, fine ears of best quality. The yield was very good.

F. G. Matts, Gardena, Los Angeles County.—The chief value of Washington Market Corn is its productiveness. There were from two to four long well-shaped ears on each stalk. The kernels are tender and sweet, but not more so than some other varieties. When ripened the ears are a reddish brown. It has vigorous habits of growth, standing as high as field corn. It is a corn we will always want to grow.

Agnes Shorteng, South Pasadena, Los Angeles County.—Washington Market Corn was very good.

J. W. Jobes, Escondido, San Diego County.—The Washington Market Corn was excellent.

Mrs. Denver O. Lamb, Fallbrook, San Diego County.—The Washington Market Corn I planted May 1st, on sandy soil near a creek, and it grew finely. It was very prolific, and we gathered roasting ears from it from July 29th until August 15th, and then left some that were fit to use. We consider it equal in all respects to any corn we ever used, and superior in respect to staying fit for use a long time.

Wm. W. Dail, Jamul, San Diego County.—The Washington Market Corn does not seem to do as well in this climate as three or four other varieties we have. It might do better on bottom land.

Mrs. S. J. Martin, La Costa, San Diego County.—The Washington Market Corn did well with us. We were well pleased with it.

NEW SHORT WHITE CARROT.

This has proved with us a very thrifty variety and both upon growth and quality seems entitled to rank among the standard varieties for California. The following reports give it such character:

Peter Bonta, Miller, Mendocino County.—New Short White Carrots did splendidly, and they are the best carrots I ever ate. My wife says they melt in the mouth.

Geo. B. Pearce, Jr., Paradise, Butte County.—The New Short White Carrot was fine. We think them the sweetest and best carrots we ever grew.

J. J. Rivers, St. Helena, Napa County.—White Carrot is a good cropper, but erratic in form, some having the outline of the Shorthorn Carrot, while about half put on the shape of the parsnip.

H. E. Brown, St. Helena, Napa County.—The Short White Carrot is too sweet.

F. G. Smith, Skaggs, Sonoma County.—New Short White Carrot proved quite an aquisition. It was planted next row to the Oxheart, and it greatly outyielded the latter. It is extra fine for the table.

R. S. Egbert & Sons, Rio Vista, Solano County.—The New Short White Carrot seed sprouted in a short time and grew rapidly. It is a very good table variety, sweet and mild.

F. Segsworth, Ben Lomond, Santa Cruz County.—New Short White Carrot is a success. I have roots that measure four inches in diameter at the top, and they have not been irrigated since early in July. They are excellent for table use when young.

C. F. Fairfield, Campbell, Santa Clara County.—New Short White Carrot: Despite the extremely dry year I raised enough to find they were of good quality and able to stand drought perhaps better than the yellow variety grown beside them.

Wm. Muth-Rasmussen, Independence, Inyo County.—New Short White Carrot did very well. It is a very desirable variety.

J. A. Crump, Elizabeth Lake, Los Angeles County.—White Carrots did well.

VEITCH'S CLIMBING FRENCH BEAN.

This variety has been certificated at English shows, and has thus far made a doubtful record with California growers:

J. J. Rivers, St. Helena, Napa County.—Veitch's Climbing Bean: It is the best French bean grown.

R. S. Egbert & Sons, Rio Vista, Solano County.—Veitch's Climbing French Bean survived when other varieties failed to withstand the dry north winds, but did not bear well and the bean seems of an inferior kind.

Paul Le Boyd, Elk Grove, Sacramento County.—Veitch's French Bean grew well, much the same as Kentucky Wonder, but we consider the latter to be of superior flavor as string beans.

H. H. Huetenberger, Oakland, Alameda County.—I did not have good luck with Veitch's Climbing Bean; they were so badly covered with mildew that it almost killed the whole plant, consequently there were not very many beans on them. I had Melde's Beans not ten feet away from the French Bean. They were of the same age, but there was not a speck of mildew on them. I think the Melde's Beans have no equal. Some of the White Meldes turned into a red flowering bean, like the Painted Lady, but have perennial roots.

Thomas Casalegno, Evergreen, Santa Clara County.—The Veitch French Beans do very well with or without poles, and are of a very quick and early bearing variety.

Agnes Shortena, South Pasadena, Los Angeles County.—Veitch's Climbing Bean did very well, but I think it a very indifferent sort.

PREHISTORIC CORN.

Experts say there is nothing "prehistoric" about it, but it is a very hardy and strong-growing cross-bred variety. Very tall and prolific of ears. It deserves further trial for ordinary purposes, and for ensilage. Ears dark red, kernels long and hard. Its early records are evidently promising:

F. G. Smith, Skaggs, Sonoma County.—Prehistoric Corn was planted April 14th. Dry weather retarded its growth. It undoubtedly requires a very long season to mature. It grows very tall and rank and has broad leaves. Sweet corn planted near by has roasting ears ready for use before the Prehistoric Corn tasseled out. But finally two or three ears appeared to the stalk. It kept green until late in November, long after all the other corn had been harvested. It yielded well, but about one half the ears were shrunken or what we term soft. I will try it again. I think it would be valuable for ensilage, on account of its heavy yield of fodder.

C. D. Guilford, Creston, San Luis Obispo County.—Prehistoric Corn planted in the garden on April 1st grew five to six feet, but bore no ears. I used it for green fodder October 1st.

F. M. Eisenhart, Elsinore, Riverside County.—Prehistoric Corn planted April 1, 1899, yielded two ears to the stalk, of good size fourteen-row corn of the dent variety. It is chiefly valuable because one can gather the corn, and the fodder will remain green for feeding. Stock eat it well. The fodder on mine is still green September 16th, and I harvested the ears. It was grown on dry ground without any irrigation. It is a good thing.

THE FLAT PEA.

This is the *Lathyrus sylvestris wagneri* which was introduced with high claims a few years ago. The following reports taken in connection with others in our earlier publications seem to round out its record as a failure in most parts of California:

Peter Bonta, Miller, Mendocino County.—Flat Peas are a complete failure. They just kept green through the best part of the summer. It is too cold and foggy.

Geo. B. Pearce, Jr., Paradise, Butte County.—The Flat Pea roots all died except what I irrigated, and they only grew a few inches high.

Chas. Strehlow, Healdsburg, Sonoma County.—The Flat Pea roots all died out except two which I watered.

H. H. Huetenberger, Oakland, Alameda County.—I had several plants of Flat Peas (*Lathyrus sylvestris*) in my garden, and gave them good care, but could get no benefit from them, so I have given it up. Now they have disappeared entirely.

F. Segsworth, Ben Lomond, Santa Cruz County.—Flat Pea is not satisfactory. The roots were planted in January on the upper side of a ditch on hillside soil. The plants nearest the ditch have remained green and made a small growth. The soil does not seem to be rich enough to suit them.

THE UNIVERSITY BOTANIC GARDEN.

By J. Burtt Davy.

Fifteen hundred labels, giving the names and usually the native countries of the plants growing in the garden, have been added this year, and a very marked increase of interest in the plant collection, by students and visitors, has been noted.

The exceptionally dry season with its rainfall of only 14.4 inches, ruined a large number of the plots of seeds sown in the open, has checked the growth of many species, and killed others, so that the general aspect of the garden has been more bare than usual.

A small greenhouse has been added to the garden without cost to the department, through the ingenuity of the gardener in using up the lumber cast aside from an old plank walk. This little house has proved of great value in the protection of small plants too young to tolerate a long dry summer.

Among the most important additions to the collection were the following:

An "offset" of the handsome "Wedding Flower" (*Moræa Robinsonia*), from Lord Howe's Island, presented by Mr. George P. Rixford. The plant was raised by Mr. Rixford from seed sent to him by the late Sir Ferdinand, Baron von Mueller in 1881, and which flowered for the first time in the summer of 1897.*

A rhizome of the Sacred Lotus of the Egyptians (*Nelumbium speciosum*), from Mr. E. R. Drew.

Collections of bulbs of native Liliaceæ, from Mr. H. P. Bancroft, of San Francisco, and Mr. Carl Purdy, of Ukiah.

A collection of fifty-two packets of seeds, collected by Mrs. C. A. Dresser, of Fresno Flats, in that neighborhood. Unfortunately they were received too late to "catch the season," and owing to the subsequent drought, the largest part failed to germinate or else to mature.

Thirty-five packets of seeds of rare plants, from Mr. W. N. Sucksdorf of Bingen, Wash., of that region, the shrubbery species of which germinated and were saved by cultivation in the greenhouse.

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* The practice is now consistently followed of placing shrubs and plants, fresh from the woods and hills, in rows in a shaded piece of nursery-ground, where they can receive frequent cultivation and irrigation till a new set of roots has been formed. By this method the decimation of the new collections from the effect of drought is largely avoided. The only exceptions to this rule are made in the case of hardy herbaceous perennials with stoloniferous roots, such as asters and some grasses.

The following is a complete list of the donors of

LIVING PLANTS AND SEEDS RECEIVED AS DONATIONS OR BY EXCHANGE.

	Rooted Plants or Bulbs.	Packets of Seeds.
Agricultural Department, University of California	12	22
Ames, Mrs. Mary P.; Auburn, Placer Co.	----	1
Atkinson, Mrs.; Berkeley	----	4
Bancroft, H. P.; 120 Sutter St., San Francisco	360	----
Barnes, Mrs. H. W.; Los Gatos	3	----
Bartholomew, E.; Rockport, Kansas	---	1
Behr, Dr. H. H.; Cal. Acad. of Sciences, San Francisco	----	3
Bioletti, F. T.; Berkeley	----	1
Blasdale, W. C.; Berkeley	22	69
Bolton, Miss Alice; Peralta Park	9	5
Bolton, Arthur L.; Peralta Park	6	10
Botanic Garden; Brisbane, Queensland	----	81
Botanic Garden; Harvard University	----	31
Botanic Garden; St. Louis, Mo.	----	5
Botanic Garden; Sydney, N. S. W.	----	96
Bunnell, Mrs.; Berkeley	5	1
Buysman, M.; Middelburg, Holland	----	8
Clarke, J. J.; Tehama	1	----
Davidson, Dr. A.; Los Angeles	----	4
Davy, J. Burtt; Berkeley	320	243
Davy, Mrs. J. Burtt; Berkeley	3	1
Day, Miss Edith M.; Ventura, Ventura Co.	----	12
Day, Mrs. Clinton; Berkeley	----	1
Dresser, Mrs. C. A.; Fresno Flats, Madera Co.	----	52
Drew, Elmer R.; Berkeley	1	----
Dutard, H.; 25 Davis St., San Francisco	6	----
Dye, H. E.; Tulare	----	1
Eastwood, Miss Alice; California Acad. of Sciences, San Francisco	----	6
Eels, A. B.; Leonis Valley, West Palmdale, Cal.	----	1
Eisen, Dr. Gustav; San Francisco	----	1
Eshleman, J. S.; Fresno	----	1
Franceschi, Dr. F.; Santa Barbara	----	1
Green, Prof. Edw. L.; Catholic University, Washington	1	1
Gunnison, A. W.; San Francisco	8	----
Guss, L. L.; Brentwood, Contra Costa Co.	----	5
Hagenbuck, Mrs. I.	3	12
Hall, H. M.; Riverside	4	11
Hanbury, Commendatore Thos.; La Mortola, preno Ventimiglia, Liguria, Italy	----	20
Harger, E. B.; San Francisco	---	2
Harshberger, Dr. J. W.; 787 Corinthian Ave., Philadelphia	----	1
Hillman, Prof.; Reno, Nevada	----	1
Hickman, J. B.; Monterey	12	----
Holzinger, J. M.; Winona, Wis.	----	1
Hooper, F. W.; Little Shasta, Siskiyou Co.	1	7
Hopkins, H. P.; Big Sur River, Monterey	1	8
Jaeger, Rudolph; Berkeley	----	7
Jamieson, H. E.; Downey	----	1
Jared, L.; Estrella	----	10
Jenks, Mr.; Los Gatos, Santa Clara Co.	----	3
Jepson, Dr. W. L.; Berkeley	7	56
Johnson, Mrs. I. E.; Los Gatos	50	----
Jones, Miss K.; Berkeley	4	----
Josephi, E.; Bakersfield	----	5
King, Miss M. A.; Berkeley	1	----
Koch, F. W.; Merced	----	2
Leckenby, A. B.; Tacoma, Washington	15	1
L'Ecureuil, I.; Santa Cruz	----	1
Lemmon, J. G.; North Temescal	5	25
Los Angeles Chamber of Commerce	----	1
Lucas, E. W.; Rosamond, Kern Co.	----	1
Lüdemann, F.; Pacific Nurseries	20	----
Lyons Nurseries, Los Angeles	2	----
Maslin, P.; Sacramento	----	1
Maynard, Mrs. T. F.	----	1
McClatchie, Prof. A. J.; Los Angeles	----	1

LIVING PLANTS AND SEEDS RECEIVED AS DONATIONS OR BY EXCHANGE.—Continued.

	Rooted Plants or Bulbs.	Packets of Seeds.
McOwan, P.; Capetown, South Africa	----	3
Manson, Dr. Marsden; San Francisco	----	2
Meeker, F. L.; San Diego	15	----
Mel, Jno.; Glenwood, Santa Cruz	----	1
Melde, Henry; Eureka, Humboldt Co.	7	2
Miller, L. H.; Berkeley	----	6
Mills, J. W.; Ontario	----	3
Mueller, Baron F. von; Australia	----	4
Nisley, P. W.	1	----
Nolan, S.; Oakland	20	----
Osterhout, W. J. V.; Berkeley	4	1
Parish, S. B.; San Bernardino	2	12
Peckinpah, Mrs. L. A. R.	----	1
Platt, R. H.; Vacaville	13	----
Purdy, Carl; Ukiah, Mendocino Co.	45	127
Reynolds, Miss Mary J.; Pomona	----	1
Rivers, J. J.; Santa Monica	3	----
Rixford, George P.; San Francisco	3	----
Rose, J. N.; Smithsonian Institute, Washington, D. C.	----	2
Royal Gardens; Kew, England	2	105
Sander, F. & Co.; St. Albans, England	8	6
Sandercock, W. C.; Winlaw, Assiniboia	----	5
Schaffer, J. S.; Tuttletown, Tuolumne Co.	----	2
Schwagerl, E. O.; Puget Sound University	----	2
Sell, Mrs.; Berkeley	1	----
Setchell, Dr. W. A.; Berkeley	3	15
Setchell, Dr. W. A., and Jepson, Dr. W. L.; Berkeley	7	----
Stearns, Elmer E.; Bakersfield, Kern Co.	----	1
Shepherd, Mrs. Theodosia B.	3	----
Shinn, C. H.; Niles	12	1
Starrell, S. E.; San Francisco	----	1
Still, A. A.; Annette, Cal.	----	3
Sucksdorf, W. N.; Bingen, Wash.	----	35
Thompson, Mrs. Harry; Peralta Park	2	----
Tidestrom, Ivar; Berkeley	----	4
Todd, G. G.; Parkfield, Monterey Co.	----	1
Trask, Mrs.; Avalon, Catalina Island	----	7
Tuohy, John; Tulare	----	3
Tyrrell, Mrs.; Lorin, near Berkeley	5	----
U. S. Department of Agriculture, Washington, D. C.	----	84
Vogt, Dr.; Palmdale, Los Angeles Co.	----	4
Weeks, Mrs.; Pacific Grove	1	----
Whiting, E. H.; Warthan, Fresno Co.	----	1
Wickson, Prof. E. J.; Berkeley	----	1
Wilks, Mrs. F. M.; San José	----	3
Wilson, N. C.	12	1
Wright, W. G.; San Bernardino	----	9
Yelland, R. D.; East Oakland	3	----

PLANTS SENT FOR IDENTIFICATION AND OPINION AS TO THEIR ECONOMIC VALUE.

January, 1897, to June, 1898.

By J. Burtt Davy.

Bishop, R. K.; Orange, Orange County.—Centaurea melitensis, Chenopodium ambrosioides, C. murale, C. rubrum, Polygonum aviculare, Marrubium vulgare, Franseria Hookeriana, Erigeron Canadense, Heterotheca grandiflora, and five other weeds, for names; the latter too immature for identification.

Bourne, D.; Auburn, Placer County.—Cheilanthes Californica and Pellaea ornithopus, native ferns, to be named.

Bradford, W. C.; Arbuckle, Colusa County.—Paspalum distichum ("Knot-grass" or "Joint-grass"); reports that it grows very rapidly during drought; roots from its prostrate stem, and stock are very fond of it. Undoubtedly a valuable grass, especially for wet soils; see also note under "Edmonds, W. O."

Braunton, F.; Los Angeles.—Sechium edule, the "Chocho," "Chayote," or "Vegetable Pear" of Central America. The large starchy root can be consumed as a vegetable, while the good-sized fruits are also edible and are very abundantly produced. They may be boiled like Vegetable Marrow or Summer Squash, or stewed with sugar. The plant bears even in the first year, and may ripen one hundred fruits in a season. It comes to perfection in all the warmer regions of the temperate zone.

Chapman, C. M.; Brentwood, Contra Costa County.—Sends specimens of Araucaria Bidwellii and Grevillea robusta, for names, and asks where they can be obtained. Sold by all the best nurserymen.

Chappell, W. W.; Nashville, El Dorado County.—Bromus virens, B. hordeaceus (B. mollis), Avena barbata, and Lupinus sp.; asks if they are good forage plants and if they need resowing from year to year. The Lupin is not considered of any value for fodder; all the grasses are eaten by stock, but are not considered as nutritious as many others. Avena barbata forms a large part of the wild hay marketed; all are annuals and must be resown from year to year or be allowed to scatter their seed. Schrader's Brome-grass (Bromus unioloides), which is perennial, would be worth trying, and would probably give a much heavier yield.

Clark, L. C.; San Francisco.—Twig of cultivated Ulmus (Elm), to be named. Material too fragmentary for specific determination.

Clarke, Capt. F. L.; Veterans' Home, Yountville, Napa County.—Euglena viridis, an alga from water in a hog-yard.

Clarke, J. J.; Tehama.—Sanicula Menziesii, to be named. A native plant.

Custer, W. Q.; Covina, Los Angeles County.—Dewberry (Rubus Canadensis); asks for reason for non-setting of fruit. Examination shows that pollen is duly formed, and there does not appear to be any defect in the organs, such as might cause abortion. Professor Wickson suggests that (1) it may be a natural defect of the particular variety, (2) it may be low temperature directly unfavorable to normal activity of the

pollen, (3) it may be self-sterile bloom, and cross-fertilization prevented by temperature too low for bees to work on bloom. Question: Does the variety do better later in the season? If so, the trouble lies in (2) or (3); if not, the variety should be abandoned; no culture will help it.

Dutard, H.; San Francisco.—"Wild Buckwheat" (Eriogonum parvifolium) from sand-dunes near Santa Barbara. Remarks that stock eat it in preference to the grass of the neighboring black-adobe lands, and grow fatter on it; it keeps green and fresh in dry seasons when other things fail. For analysis, see pages 133–4.

——— ——— Eriogonum polifolium from the Antelope Valley, Los Angeles County; asks if it is the same as E. parvifolium, and whether it is as valuable, remarking that it has not the same taste. E. polifolium has been considered by some botanists as only another variety of the same species to which E. parvifolium belongs, but by others it is retained as a distinct species. In the Antelope Valley it is eaten by stock at certain seasons of the year.

Dye, H. E.; Tulare.—Sends Bromus rigidus. Reports that it "lines the roadsides hereabouts, presumably dropped there by traveling bands of sheep." He never noticed it before this year, though it is quite as conspicuous as foxtail (Hordeum murinum) and he would not be likely to fail to see it if it had been there. "It grows taller and keeps green longer than foxtail," and he considers the awns not nearly so injurious to stock. "It was mown three and a half weeks ago (early in May, 1897); you can see the stumps and how it stooled out for the second crop." Adds that it seems to be driving out foxtail; that it is a fall and winter grower, starting with the first rains, growing faster and taller and keeping green two or three weeks longer than foxtail, "which is a very great item, as foxtail often heads out too short to cut."—Bromus rigidus is not considered of any value for forage.

——— ——— Sends Eragrostis major, and asks if it has any value as a fodder grass. Professor Beal states that "the glands secrete a substance emitting an unpleasant odor, offensive to animals." It is of no agricultural value.

Edmonds, W. O.; Upper Lake, Lake County.—Sends "Knot-grass" (Paspalum distichum) for name and relative value as a forage plant. He says: "In the past seven years it has completely taken possession of my tule land, and has proven a wonderful fodder grass, keeping numbers of cattle in the best possible condition, and turning off the choicest beef. The water stands on this grass usually three months every winter, but in spring it comes along as profusely as ever. If it was of paying feeding value, as hay, I could cut two or three tons to the acre. I feel sure that on analysis the result will be most gratifying, judging from the rapid growth made by all my young stock while on it, in the green state. Beef grown upon it is of exceptional quality, and much sought after by the local butchers. I feel sure that it would be an excellent milk-producing pasture." Mr. Leckenby reports that he considers it much the best grass for wet places of all that he has tried at Bakersfield. Professor Killebrew reports that around Nashville, Tenn., it makes excellent forage, and that cattle are very fond of it. Analyses made in Melbourne, Victoria, by Mueller and Rummel, show 9.91 per cent of crude protein. Mr. S. B. Parish, of San Bernardino, reported in 1890 that "it often overruns alfalfa fields, entirely superseding the original

crop." Mr. W. A. Saunders, as quoted by Dr. Vasey, wrote (about 1888): "Are you aware of the value of Paspalum distichum for seeding pond-holes that dry up, or nearly so, in autumn? Such spots are usually spots of bare stinking mud, but when well set to this grass will yield all the way up to eighty tons (in the green state) of autumn feed for stock, especially valuable for cows first, then follow with sheep, until every vestige is devoured. Surely it has an immense food value in such places."

Eshleman, J. S.; Fresno. — Many-flowered Millet-grass (Oryzopsis miliacea). It makes a great abundance of excellent forage, is practically frost-proof, and its young growth comes at a time when the growth of more desirable plants is retarded. (Prof. Wickson.)

Hooper, F. W.; Little Shasta, Siskiyou County.—Sends Platyspermum scapigermum, Capsella Bursa-pastoris, Brodiaea capitata, Collinsia parviflora, Thysanocarpus curvipes, Sisymbrium incisum, Tellima tenella, and two immature specimens, for names.

——— ——— Sends Ranunculus glaberrimus, Baeria sp., Viola Beckwithii, Sisyrinchium grandiflorum, and Fritillaria pudica, to be named.

Hutchinson, A. J.; Lindsay, Tulare County.—Lupinus leptophyllus and L. micranthus; asks for names and whether they would prove serviceable for green-manuring. Both are native Lupins; the former might prove serviceable and is being tested at this Station; the latter is usually too small and sparse in its growth.

Jaehne, S. A. E.; San Francisco.—Liatris odoratissima leaves, for name.

Josephi, D. E.; Bakersfield, Kern County.—Salvia carduacea, Festuca microstachys, Eriogonum angulosum, and imperfect specimens of Mentzelia, Lotus, Amsinckia, Malacothrix, etc., illustrative of the natural vegetation of the "weedpatch," near Bakersfield, Kern County.

Leckenby, A. B.; Bakersfield, Kern County.—Lotus Wrangelianus, Plantago Patagonica Californica, Salvia columbariæ, Malacothrix Coulteri, Monolopia major, Anthemis Cotula, Mentzelia affinis, and fragmentary specimens of Krynitzkia (?) and Astragalus; plants growing where six hundred sheep had been poisoned. Mr. Leckenby reports that sheepmen near Bakersfield say that the Mentzelia sometimes causes death to sheep. The leaves of Mentzelia affinis are clothed with barbed protuberances which cause them to adhere to and accumulate foreign matter very easily, and it is conceivable that they would have the same effect in the stomach and intestines of animals, if eaten in quantity, forming indigestible balls of the same nature as the injurious Crimson-Clover hair-balls, eventually plugging the intestines and causing inflammation of the bowels. Or possibly these stiff barbed protuberances when taken into the stomach in quantity may penetrate the membranes and cause inflammation. It is possible, also, that the Astragalus may be a poisonous species, but we think not; the material sent us was too fragmentary for accurate determination in so critical a genus. Finally it has been suggested that the sheep may have had unaccustomed access to an alfalfa crop; that the sudden change of diet may have induced them to over-eat; or that the alfalfa was badly diseased with an injurious fungus. While all these suggestions are presented, it is impossible to form a decided opinion with the meager data supplied.

——— ——— "Yerba Mansa" (Anemopsis Californica), for name. Considered a valuable remedy for sprains or bruises of man or animals.

Los Angeles Chamber of Commerce.—Forestiera Neo-Mexicana; asks if it is a wild olive. It belongs to the Olive family (Oleaceæ), and occurs not infrequently around springs and moist places of the border of the Mojave Desert and eastward to Texas.

Macleod, George B.; Matilija, Ventura County.—Sends Bromus sterilis, and asks if it is a good fodder grass. It is considered worthless for agricultural purposes.

MacVine, John; Sunland, Los Angeles County.—Eucalyptus cornuta near the var. Lehmanni; reports that it is a valuable bee plant, flowering in January.

Maslin, P.; Sacramento.—Araujia sericifera, a garden climber from Peru, for name. Known to nurserymen as Physianthus albens.

Mathews, Wright; Lakeport, Lake County.—Cupressus species, for name. Material incomplete.

Maynard, Mrs. T. J.; Walnut Creek, Contra Costa County.—Lupinus luteolus, for name.

McEuen, D. N.; Winchester, Riverside County.—Fragmentary specimens of Eucalyptus, for name.

Mumma, W. R.; Grand Island, Colusa County.—Centaurea solstitialis ("St. Barnabas Thistle"). Reports that it was first noticed in that region eighteen years ago. The methods recommended as best for the extermination of this injurious weed are: Cultivation with hoed crops (as it is an annual and easily killed by hoeing before the taproot has grown long and woody); or if it has been allowed to grow large, then burning patches of the mature plants before the seeds ripen.

Noack, Harry R.; Berkeley, Alameda County.—Fragmentary specimen of Stachys ("Stinking Horehound"), for name.

Paige, Cutler; San Francisco.—Quercus Wislizeni ("Scrub Oak"), Vaccinium ovatum ("Whortle-berry"), Xylothermia montana, Arctostaphylos Manzanita ("Manzanita"), and Arctostaphylos pumila, for names.

Raymond, George A.; San Francisco.—Azolla (probably A. filiculoides, but specimen imcomplete), for name.

——— ——— Sends a grass asking if it is Tussock-grass (Sporobolus airoides) mentioned in Experiment Station Report for 1896–7, p. 73. It is Tracy-grass (Leptochloa Tracyi). Mr. Raymond reports: "It grows freely in the artesian belt of Kern County, where it gets plenty of water, principally on the inside of ditch-banks close to the water, or where the land is overflowed; it grows in thick bunches and very rapidly. It does best in non-alkali soil, is an annual, and does not stand frost; grows best in hot weather. Stock eat it fairly well when green; it is of no account as hay. It is a great nuisance with us, as the seeds float along in the ditches and take root and flourish tremendously. It is almost impossible to raise strawberries and such small plants on account of it. It bunches out and the roots spread so widely that in pulling the plants up, a section of earth eight or ten inches in diameter comes with it." The spread of this weed should be checked before it gets beyond control; care should be taken to hoe off the plants before they produce seed. To quote the advice of the Department of Agriculture at Washington as regards weed extermination (Year-book for 1896): "Annual weeds are choked down by dense crops of grain,

clover, or cow peas. Therefore, as a matter of prevention, land not in use should be seeded with forage or soil-renovating crops, while corn fields, potato fields, and gardens should, where practicable, be covered during fall, winter, and spring with crops of winter wheat, rye, or crimson-clover. To put a stop to the production of seeds is a necessary part of the process of eradication. An average full-grown plant of prickly lettuce produces about 8,000 to 15,000 seeds, a medium-sized Russian thistle about 2,000, while a single plant of purslane has been estimated to bear 1,250,000 seeds."

Rey, W. J. A.; San Francisco.—Juncus effusus and Agrostis scabra from Angel Island, for names.

Rivers, J. J.; Santa Monica, Los Angeles County.—Abronia umbellata, as the probable host of the parasite Pholisma.

Mr. Rivers also sends Calystegia Soldanella and Abronia umbellata, one or the other of which appears to be the host of Pholisma arenaria, formerly supposed to be parasitic on the roots of oak trees (Quercus sp.). The Pholisma appears to be parasitic upon the roots of the Abronia, on which numerous large swellings are formed, somewhat similar to those produced by Boschniakia strobilacea on the roots of its host-plant. The Calystegia does not show any signs of having been attacked by the parasite.

Robertson, George; Mentone, San Bernardino County.—Lupinus concinnus, for name.

Robinson, J. G.; Santa Clara.—Leaf of Mullein (Verbascum), for name and method of propagation. Specimen too fragmentary. All the Verbascums commonly cultivated are hardy biennials, and only require to have the seed sown in ordinary soil.

Royce, Mrs. L. D.; Emeryville, Alameda County.—Incomplete specimens of Eriogonum and Lupinus. Asks if they are "loco weeds." Not known to be injurious to stock.

Schaffer, J. S.; Tuttletown, Tuolumne County.—"Blue Curls" (Trichostema lanceolatum); asks if it has any medicinal value. Not known to be used for medicinal purposes.

Smith, Alex.; Corning, Tehama County.—Aphyllon Californicum; "contains tannic acid in considerable quantity." Material insufficient for analysis.

Spear, C. E.; Waddington, Humboldt County.—Orthocarpus pusillus, a parasitical plant, which kills out grass and clover. The best method of extermination seems to be hoeing out before the seeds ripen, as the plant is an annual.

Sprague, A. R.; Fairmont, Los Angeles County.—"Ivy" (Hedera helix); asks if it is injurious to trees. Ivy is not a parasite in the strict sense of the word (like Mistletoe or Dodder), and does not draw any nourishment from the tree over which it climbs; sometimes, nevertheless, it will kill a tree by smothering it when allowed to grow very rampant. It is customary in some places to cut the ivy tops when they reach the forks of the secondary branches.

Southern Pacific Railroad Company, San Francisco.—Tamarix sp. (probably T. Gallica, the common "Tamarisk," but specimen incomplete). A useful ornamental shrub for dry localities, levees, etc.

Stetson, E. G.; San Francisco.—Danthonia Californica, a native dry-ground forage grass, for name and method of propagation. Best method of propagation is by sowing the seeds, which can be easily collected.

Stivers, H. F.; Hunters, Tehama County.—Lupinus affinis, for name.

Timm, W. D.; Rio Vista, Solano County.—Nitrophila occidentalis, an alkali weed. Came up on land sown with Atriplex semibaccata and Modiola; asks if it is Modiola.

Todd, G. G.; Parkfield, Monterey County.—Turkey Mullein (Croton setigerum), as of possible value for sacking and sack twine. It has a very strong fiber, but there are two serious objections to it; the first is that with us it usually spreads on the ground, branching low and profusely, which would seriously interfere with the extraction of the fiber and would conduce to the production of short fiber; second, the stellate hairs fall off readily when the plant is dry, causing serious irritation to the eyes and nostrils of those working with it.

Vogt, Dr.; Palmdale, Los Angeles County.—"Creosote bush," Larrea Mexicana (Zygophyllaceae), for name and name of family.

Whitehead, D. Radcliffe; Santa Barbara.—Eucalyptus corynocalyx, for name.

Whiting, E. H.; Warthan, Fresno County.—Phalaris intermedia; says that horses are very fond of it.

Miscellaneous Specimens.—Audibertia polystachya, Artemisia Californica, Eriogonum fasciculatum, Aplopappus Palmeri; characteristic plants of soil sent for analysis. Pittosporum Tobira, for name; an ornamental shrub from Japan. Sherardia arvensis, a weed in lawns; introduced from Europe. Fiber of Kapok (Eriodendron anfractuosum), for name. Aster lentus and Eleocharis palustris, wet-land indicators, for name. Acorns of Quercus pedunculata, for examination as to viability. Erysimum, Capsella, Lupinus, Trifolium, Panicum (?), Erodium, characteristic plants of soils sent for analysis. Lupinus carnosulus, for name. Distichlis spicata (salt-grass), to be named; it is a good forage grass for dry alkali lands. Plantago lanceolata and Lotus Americanus; Panicum crus-galli and Paspalum distichum; Phragmites vulgaris and Paspalum distichum; Salt-grass (Distichlis spicata); Pittosporum crassifolium; Angophora lanceolata; Agrostis alba; "Pochote"-fiber (Eriodendron anfractuosum); "Daphne" (Pittosporum Tobira); Panicum crus-galli and Panicum sanguinale; Vicia micrantha (?); Hakea acicularis; Pterospora andromedea; Colocasia esculenta; Verbascum formosum; Acacia mollissima, var. nigricans; Eucalyptus amygdalina and E. amygdalina angustifolia; Passiflora cœrulea; all to be named.

REPORT ON THE SUBSTATIONS.

By Charles H. Shinn, Inspector of Stations.

There are six outlying stations, branches of the Central Station, and the seven taken collectively form the California Experiment Station. Four of these six substations are supported from the Hatch Fund, and two, known as the forestry stations, are now supported from the general fund of the University, although they were formerly supported by a direct State appropriation. The funds at present devoted to the forestry stations are so small that their proper development has been seriously checked.

The substation system has always been necessary in California, since the variety of soils and the diversity of climates are so great here. The Central Station was planned to cover the general ground of agricultural science and practice; the substations were primarily instituted as culture-stations where the adaptations of plants to local climates and soils could be systematically tested, and where the exceedingly difficult local problems of California agriculture could be more directly reached. The Berkeley climate, as all agriculturists understand, represents little more than Berkeley itself. The Australian saltbushes, now so successful over large areas of California, could never have been tested and disseminated from Berkeley alone; it has taken eighteen years of time and long and costly experiments at four substations as well as at Berkeley, to establish this valuable new crop.

In 1888, in Bulletin 78 of the California Experiment Station, the Director recommended five culture stations, based upon the leading natural agricultural subdivisions, as follows:

(1) Southern region, from San Diego to Santa Barbara, and inland to the Mojave and Colorado Deserts;

(2) San Joaquin Valley, from the Tejon Mountains to Stockton;

(3) Sacramento Valley;

(4) Foothills of the Sierras, from Fresno to Tehama;

(5) Coast Range region.

This, as the Director then said, is the minimum number that can at all represent the State, and a larger number of substations would be very desirable. The Sacramento Valley is not yet represented, except by a forestry station.

Four such general substations have now been established: the "Sierra Foothill," in Amador County; the "San Joaquin," in Tulare County; the "Southern Coast Range," in San Luis Obispo County; and the "Southern California," in Los Angeles County.

Substations such as these could, with much profit to the agriculture of California, be located in the upper Sacramento Valley and in the northern Coast Range. If a third such new station were placed on Mount Hamilton, where the University controls a large tract of land, the higher portions of the Coast Range, to an altitude of 4,000 feet, could

receive much needed investigation, and such important cultures as that of the cork oak could be established.

The organization of the existing substations is extremely simple. Each has a local patron, or trustee, residing in the nearest town. The only salaried executive officer of each station is the foreman. These foremen are careful, painstaking, intelligent men, selected for their practical knowledge, and they have, without exception, done their best to improve their respective substations. They make weekly reports, as well as extended special reports to the Central Station, and often to the Deparment of Agriculture at Washington; they keep a great variety of necessary records, and attend to a large and rapidly increasing correspondence. They take part in Farmers' Institutes, and many meetings of similar organizations, and do what they can by study and observation to improve their own knowledge of agricultural principles. In addition to these varied duties, they do a great deal of manual labor.

All of the substations have very considerable collections of books, pamphlets, and other publications upon agriculture. Every effort is being made to complete the valuable sets of Government and State reports, at these substations. They are carefully classified, and are loaned to farmers and others whenever desired.

Gratifying interest has been shown in the substations by the communities in which they are situated, and the number of visitors who come and come again, finding something to interest and help them, is certainly increasing every year.

The general principles which govern the relations of all the substations to the public were not long ago defined by the following Rules and Regulations, adopted by the Board of Regents and sent out by the Department:

"1. The foreman is a local representative of the Agricultural Department, a subordinate officer, in charge of State or National property, and is only answerable to his superiors at Berkeley.

"2. The general public is cordially welcome at every station, and the foreman is required to be polite to all visitors. The foreman is expected to show visitors everything of interest. He must not allow them to gather flowers, fruits, vegetables, seeds, branches of trees, or anything else. Whatever is desired by any person must be asked of the foreman, who is to decide whether the request is a proper one, and must himself gather the specimens. No visitor can be given special privileges.

"3. Visitors must not be allowed to unduly interfere with the regular work of the Station, and must not encroach upon the rightful privacy of the foreman and his family."

A. THE FOOTHILL CULTURE SUBSTATION.

(Five miles north-northeast from Jackson, Amador County; highest elevation, 1,975 feet.)

The Foothill substation is situated in the midst of a very interesting mining and fruit-growing district which has been prosperous for many years, and is representative of a very large area of the lower Sierra region. It is reached by taking the railroad to Ione or to Valley Springs, from both of which points stages run to Jackson, the county seat of Amador. The Volcano daily stage from Jackson passes near the station. If local information is desired by intending visitors, the Patron, Judge R. C. Rust, of Jackson, who has served several years with noteworthy efficiency, can be depended upon to extend every courtesy.

There being few places of resort in the region, the station is becoming very popular, and there are times when forty or fifty people visit it in a single day, taking away impressions more or less distinct of the experimental work of the station. Actual farmers and fruit-growers come more and more frequently from Amador, Calaveras, Tuolumne, El Dorado, and Placer counties.

Rebuilding the Cottage.—In the summer of 1897 it was decided to tear down the main building of the station, using the materials to construct a smaller and better-built cottage nearer the center of the grounds, and much more convenient and accessible. The work was completed in the autumn of 1898. The building taken down was originally erected upon the highest hilltop of the station tract. It was a frame two-story building of eight rooms besides the tower, and its site was 168 feet above the water ditch, and 90 feet above the site chosen for the new cottage. The soil on the hilltop is extremely poor and unfit for cultivation, while the expense and difficulty of pumping water so far had precluded the possibility of properly keeping up a garden, propagating-house, or lawn, and has rendered protection from fire impossible. The dwelling-house was too far from the barn, and the amount of time necessarily spent by the foreman and workmen daily climbing the hill was a serious loss to the effectiveness of the station. When, in addition to these difficulties, it became evident in 1897 that the house was not built strongly enough to withstand the severe wind storms for many more years; when the plaster fell in several rooms; when the roof leaked; and when an estimate of the sum needed for repairs equaled more than half the cost of tearing down the old building and making a modern six-room cottage near the center of the tract and on the same level as the barn, sheds, and other buildings, there could be no question respecting the propriety of the course taken.

Mr. J. W. Neal, formerly of Paso Robles substation, who was appointed workman-in-charge in June, 1897, had fortunately received some training as a carpenter and builder. Without any additional expenditure for materials or labor, he was able to take the old building down, beginning in September, and the lumber was piled under a temporary shed. An excellent granite foundation was made (one of the best in the county), the stone rough-hewn being presented to the station

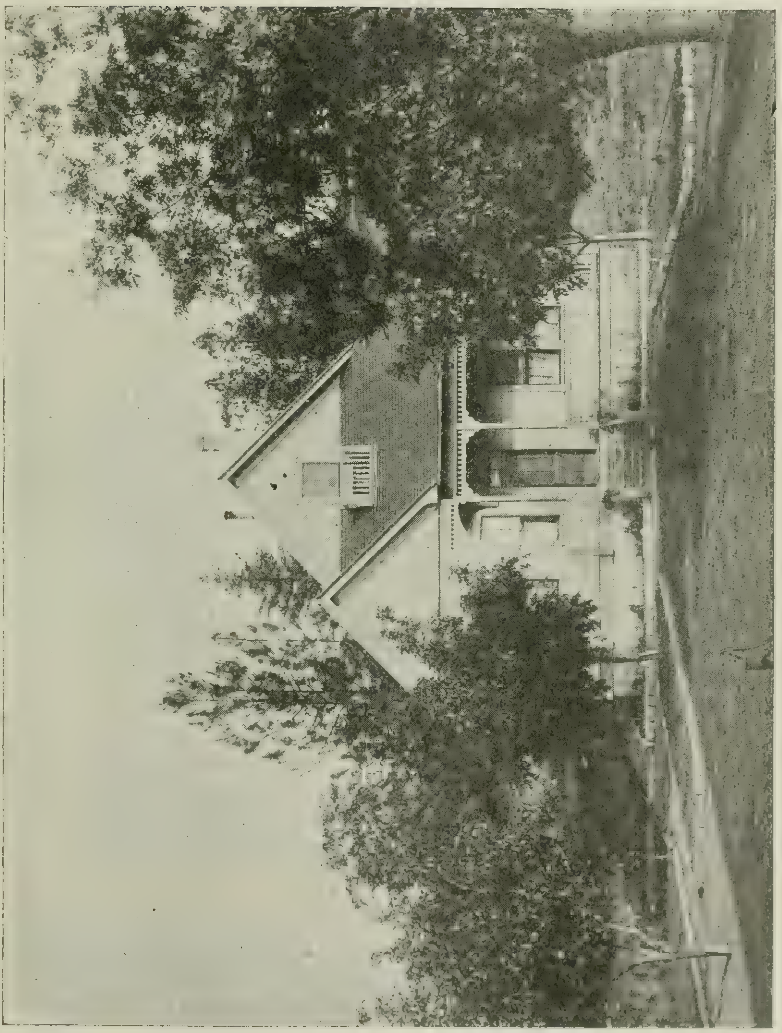


PLATE 24. THE FOREMAN'S COTTAGE, FOOTHILL SUBSTATION.

by the Portichelli Brothers and Mr. S. Molfino. Some new lumber was purchased, also shingles for the roof; but little outside labor was hired until it came to plastering. The total cost of the new cottage in money outlay has been something over $900, and in all essential particulars of usefulness, solidity, and general appearance, it compares favorably with the ordinary $1,800 cottage. (Plate 24.)

An economic garden has been laid out near the new cottage, also a small lawn and garden-beds. A number of fine, large walnut trees line the new entrance to the cottage grounds, and the driveways have been changed to conform with recent improvements. Water from the reservoir can now be thrown entirely over the cottage in case of fire.

The Arboretum.—The hill on which the residence formerly stood is unfit for cultivation, but many attractive native trees and shrubs already grow there, and suitable exotics are being added so as to make a representative arboretum. A collection of eucalypts and acacias was planted in the spring of 1897, and is doing well. Among the trees previously planted and now thriving upon the very top of the hill, without irrigation, are a number of mulberries and pomegranates, all of which bear fruit every year. There were also roses and other shrubs, and ornamental vines.

In the spring of 1898 quite a number of trees from the forestry stations were planted upon the hill to test their adaptation to the foothills under wild, uncultivated conditions. Among the species now represented here, and doing well so far, are *Zelkova keaki*, the noted hardwood timber tree of Japan; *Aphanantha aspera*, *Celtis Australis*, and *C. occidentalis;* several of the Coluteas; a number of Robinias and Gleditchias of various horticultural types familiar in European gardens; eight species of oaks (*Quercus macrocarpa*, *Q. coccinea*, *Q. alba*, *Q. nigra*, *Q. rubra*, *Q. ilex*, *Q. cerris*, *and Q. densiflora*); a fine tree of *Arbutus Menziesii*, the native Madrone; also Maples, Hawthornes, Magnolias, American Persimmons, several Hickories, the *Maytenus boaria* of Chili, and some very ornamental Genistas and Cytisuses.

It is practicable to naturalize here with light expense and without any cultivation except for the first year or two, a large number of species of trees and shrubs valuable for this district for ornamental or for economic uses. The flower-bearing or berry-bearing trees and shrubs that will thrive here under the same conditions as the native oaks, pines, manzanitas, wild lilacs, and Christmas berries, can safely be planted anywhere in the Sierra foothills.

General Condition.—During the past three years the progress made by this substation has been great and continuous. The cultivation of the soil in both orchard and vineyard has been excellent, and the crop of 1897 was better as a whole in both size and quality than in any previous year since the station was established. In 1898 the fruit crop suffered from drought and late frosts. The crop of 1899 was excellent.

The gutters of the hillside roads have been filled with broken rock picked from the vineyards. No more rock wall has been necessary nor any more blasting, but many stumps have been taken out in the hay field. Breaks in the road caused by winter rains have been permanently repaired with rock. The road leading from the main county road to

the station has been well kept up, and was fenced upon one side in the spring of 1899.

Mr. Oneto, whose land joins the station tract on the south, has given about an acre of land on the top of the hill, which brings some fine oaks and pines within the boundaries, and greatly improves the appearance of this part of the station grounds. The land is otherwise valueless except for a little pasturage.

A small but very successful alfalfa field has been planted on rich soil by the water ditch, ground formerly used for vegetables, and has been cut three times in a season.

NOTES ON CLIMATE.

The following tables were largely compiled by Mr. Neal, the present foreman, from his own records and those of his predecessors, and show some striking variations in recent years. One of the most important of these is in the amount of rainfall.

Rainfall.—Between 1889 and 1896, the mean annual rainfall was 41.44 inches. The maximum annual rainfall during this period was 54.18 inches, and the minimum was 34.22. The rainfall of 1896–7 was 42.98 inches, or above the average, but during the winters of 1897–8 and 1898–9 it fell far below the average. In 1897–8 the total rainfall was 19.55 inches, and in 1898–9 it was 29.61, giving an average for the two seasons of 24.58 inches. The new "dry-season record" of 1897–8 (19.55 inches) was only a little more than half the minimum of previous records (34 inches). With such a rainfall on the light foothill lands, orchards seriously suffered.

STATISTICS OF MONTHLY RAINFALL.

Season.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1897–8	.12	.19	3.05	2.25	3.18	1.49	4.91	1.18	1.11	1.64	.43
1898–9	none	.40	1.04	2.11	2.70	5.20	.57	14.60	1.49	1.07	1.00

While the station records since 1889 show that there has sometimes been a little rain every month in the year, June, July, and August are the dry months; September, October, and May are months of very light rains; February sometimes shows a decided gap between the earlier and later rains.

Frosts.—Killing frosts occur, but orange trees are bearing at the station and roses bloom all winter, so that the mildness of the winter climate is evident. The lowest degree of frost recorded at the station since 1889 was 16° Fahr.; and 20° Fahr. was once recorded. Both occurred in January, 1898.

FROST STATISTICS.

Month.	Number.	Lowest Degree.
1897-8.		
November	9	26
December	10	26
January	17	24
February	—	—
March	24	26
April	1	32
1898-9.		
November	4	30
December	15	26
January	20	16
February	4	30
March	15	24
April	3	30
1899-1900.		
November	3	30
December	8	26
January	3	26
February	7	20
March	2	30
April	2	30

The frost of January, 1898, and February, 1900, did not injure orange, olive, or fig trees. It will be noticed that the next highest monthly minimum was 24°.

Temperature.—Records kept at the station since its establishment and carefully compiled by the foreman show that the maximum of 106° Fahr. has been twice reached—in July, 1896, and in July and August, 1898. In 1897 the maximum of July was but 96°, and of August, 88°. On only eight or ten days in a year does the thermometer rise above 100°, and the sea breeze seldom fails. The climate is a representative Sierra Foothill climate for the elevation, about 2,000 feet, in the central portion of the State.

THE ORCHARD.

POME FRUITS.

Apples and *Pears* have received very full attention in previous reports. The tree-nursery, in which some five hundred varieties are now growing, illustrates the adaptation of soil and climate to these fruits, as the varieties grown cover the widest range, being from Russian, Hungarian, German, French, English, Canadian, Australian, and American sources. In the apple orchard twelve varieties bore fruit in 1896 and twenty-four in 1899. The pears need trial on stronger and deeper soil, but they are taking root better than formerly, on the thin soil near the entrance.

STONE FRUITS.

Almonds.—According to the latest notes (page 309, Report of 1895-6 and 1896-7) they have been a failure here.

Even in the cases where some crop was obtained, the total yield of 1896 was small, owing to late frosts. Languedoc and Drake's Seedling gave the best results. No tree bore more than ten pounds.

In 1897, Drake's Seedling bore fifteen pounds; none of the others bore over five pounds. Languedoc and Texan Prolific were next to Drake's Seedling in desirability here, but none of the varieties tested are satisfactory. As usual, Drake's Seedling is the latest in bloom.

The frosts of March, 1898, killed all the blossoms on every variety, warm weather having unduly hastened the opening of the flowers. Hard-shell seedlings in the district have borne better and more regularly than any of the grafted varieties. The crop of 1899 was better than that of 1897. Languedoc, the best tree, yielded twenty-six pounds.

Apricots.—The crop was almost an entire failure in 1896. During 1897 the apricot trees grew somewhat, but did not fully recover from the trying effects of the previous season, as the amount of crop shows. The blooming season was a fortnight later than normal and a month later than in 1896, being from April 6th to April 12th.

In the following table showing fruitage in 1897 the remarks are taken from the observations of Mr. J. W. Neal, then workman in charge, now foreman:

APRICOTS STATISTICS FOR 1897.

Variety.	First Ripe	Last Ripe.	Crop.	Remarks.
			lbs.	
Sardinian	June 12	July 20	10	Very small; sweet and juicy; slow to ripen.
Hemskirke	June 18	June 25	15	Small, dry, and sweet.
St. Ambroise	June 20	July 2	8	Poor, and easily sunburned.
Oullin's Early	June 20	July 1	140	Sweet and juicy.
Flickinger	June 20	June 26	12	Medium size; dry flesh; excellent quality.
Royal	June 21	July 1	20	Small here, but very sweet.
Montgamet	June 21	July 2	130	Very large; solid; rather sour here.
Early Rivers	June 22	July 2	15	Poor, and easily sunburned.
De Coulorge	June 28	July 9	50	Large and solid; good flavor.
Peach	June 29	July 9	12	Very large and highly flavored.
Moorpark	June 29	July 8	50	Large, sweet, and juicy.
Breda	June 30	July 7	2	Very small and sour.
Purple	July 2	July 10	3	Small and plum-like; good flavor.
Beauge	July 3	July 10	120	Small; flesh dry, white, and sweet.

It is easy to see that among the best varieties here are De Coulorge, a variety quite new to California; Montgamet, highly recommended elsewhere; and Moorpark, which has borne fairly well here. Beauge, Sardinian, and Oullin's Early are too small for market uses, sometimes running from twelve to twenty-five to the pound. Peach and Montgamet, on the other hand, run six and seven to the pound, which is a very fair size on unirrigated hillside soil. The lack of sweetness in Montgamet as grown here is very noticeable and constitutes a decided drawback to this otherwise excellent variety.

In respect to appearance of fruit and growth of trees, the foreman lists as best, in order named, Peach, De Coulorge, Moorpark, Montgamet, Flickinger, and Beauge.

The severe frosts of March, 1898, killed the apricot crop, as in many other districts of the State. The trees showed leaves nearly a month earlier than in 1897, and blossomed from ten to fifteen days earlier. The trees made a new growth and did fairly well. In 1899 the season was again poor, the fruit buds remaining dormant, and only Beauge and Purple yielded well. The fruit of Beauge was larger than in previous seasons, being about eight to the pound.

Nectarines.—The nectarine has heretofore been reported in connection with the peaches, to which it bears so close a relationship, but its importance seems to justify a separate treatment. The trees do not always thrive where peaches do; they are certainly more sensitive to cold and drought, and the best of culture is required to bring the fruit to perfection. In 1895 and 1896 the nectarine crop was decidedly poor; in 1897 it was better, though not yet up to the desired standard. All the trees are on red slate soil.

The nectarine crop of 1897 was small, ranging from two to twelve pounds per tree. The fruit was of fair size. Hardwicke and Victoria appeared to be the best varieties for the district. In 1898 the crop of nectarines and peaches was destroyed by frost. In 1899 the crop was first rate, ranging from twenty to fifty pounds per tree.

Peaches.—This fruit is so important, being decidedly the leading fruit crop of the Sierra foothills, that some review of previous years' results seem justified. A part of the peach orchard on red soil is shown in the illustration (page 272) of a portion of Reservoir Hill.

The leading yellow clings grown here are California, Runyon's Orange, Sellers, Cleveland, Henrietta, and Lemon. All are of excellent quality, and have now been tested for seven successive seasons. In 1896 the first blossoms appeared about February 26th, and in 1897 not until April 6th. Tuscany has ripened as early as July 26th (1897) and as late as August 18th (1896). With all these clings the seasons vary from year to year about a month. The years 1893 and 1899 were "early." The crop always matures rapidly, there being only from five to eight days between "first ripe" and "last ripe." The yield of a single tree in good seasons has been from sixty to one hundred pounds.

The white clings of chief value here are McKevitt's, Wilkins, Heath, Governor Garland, and Honey. They blossom at about the same season as in yellow clings, above noted, but their range of ripening is longer; Wilkins in 1896 has a fruit period of ten days from and after October 7th. The Heath is more easily frosted than are other white clings, and bears as heavy a crop as do the yellow clings.

Three tinted clings, Chinese, Oldmixon, and Indian Blood, are grown. The first of these is the best in quality and the hardiest. Both the Chinese and Honey (Honey type of the south, classed with Pallas and Oviedo) are extremely healthy. No part of California promises better results with the new Southern peaches.

All the standard freestone varieties are grown, and among the best yellows, after seven years' testing, are Crawford, Foster, Muir, Susquehanna, Lovell, Smock, and Salway. Among the best whites are Morris, Mrs. Brett, and Ward's Late. Among the best tinted freestones are Alexander, Amsden, Strawberry, Grosse Mignonne, Late Admirable, and Columbia.

The time of "first bloom" ranged over a period of forty-five days, in different seasons. Salway showed a range of thirty-four days in "first ripe" from August 27th to October 1st, which is very unusual. The actual bloom period from first to last bloom is from eight to ten days, and the actual fruit period from "first ripe" ranged from four to eight days. The pure white peaches (with no red at the pit) seem a little more tender than others. In 1897 all varieties flowered over a month late, but ripened a fortnight earlier than in normal seasons.

The tinted freestones show less range of blossoming and fruitage than do others of the freestones, and are as a rule good bearers. The list of tinted freestones is a very large one and some which belong in this class are more or less highly colored to the pit. It is a very attractive and highly flavored class, to which belong Carmine, Crimson Beauty, Waterloo, Briggs' May, Governor Garland, Large Early York, Mountain Rose, Stump the World, Oldmixon, and many others.

The foreman reported that the best varieties grown at the Station are the following:

Early varieties: Ulatis, Governor Garland, Schumaker, Briggs' May, Alexander.

Clings: Tuscany, Runyon's Orange, Albright's, Henrietta, Honey, Chinese, Wilkins.

Freestones: Alberta, Newhall, Wheatland, Crawford's Late, Richmond, Morris White, Mountain Rose.

These nineteen varieties can be strongly recommended to planters in similar districts.

Cherries.—Owing to the ravages of the birds, few statistics have been obtained upon the crop borne by the cherries, but the best part of the orchard is near the new cottage, and, therefore, is now better protected. The notes in last Report (page 315), respecting gum disease and the trying climate, remain true, with little change, after two more years of observation. In 1897, the cherries that bore fair crops on slate soil were of the following varieties: Belle d'Orleans, Early Rivers, Knights' Black, Werder's Early, Centennial, Bauman's May, Willamette, Windsor, Yellow Spanish, and Napolean Bigarreau. On the same soil were Black Tartarian, Lewellyn, Early Richmond, Schmidt's Bigarreau, Reine Hortense, Early Purple Guigne, Empress Eugenie, Major Francis, Elton, Belle Magnifique, and some other varieties that did not bear owing to the frosts.

On the granite soil at the base of Reservoir Hill (plate 25) are Olivet, Nouvelle Royale, May Duke, English Morello, Rockport, Bigarreau, Guigne Tres Precoce, California Advance, Purity, Centennial, and Black Mastodon. These bloomed at the same time as did the trees on slate soil, but leafed out several days later. Some bore a little fruit, ripening at the same time as that on the slate, but they have gum disease badly, and will soon have to be replaced. Olivet bore well, as it usually does here. There was little fruit in 1898, but a fair crop again in 1899.

Plums and Prunes.—The last report closed with crop statistics for 1895 and gave notes on varieties that had proved failures. Subsequent records continue to show that the plum, like the cherry, is a difficult fruit to grow well in this region. Nevertheless some varieties are much safer than others. In 1896 the best plums were: Burbank, Duane's Purple, Royal Hâtive, Jefferson, McLaughlin, Red Egg, Prince Englebert, and Imperatrice. The best prune was Petite d'Agen. In 1897 the plum and prune crop was almost a failure, but Kelsey, Botan, Burbank, Prince Englebert, Prince of Wales, and among the prunes Datte de Hongrie yielded very well. In 1898 the frost destroyed the Japanese plums. The best varieties were Prince of Wales, Columbia, Prince Englebert, Coe's Golden Drop, and Imperatrice. The best prunes were Petite d'Agen and Datte d'Hongrie. In 1899 the following kinds were the best bearers.

Japanese varieties: Satsuma, Botan, Burbank, Chabot, Kelsey.

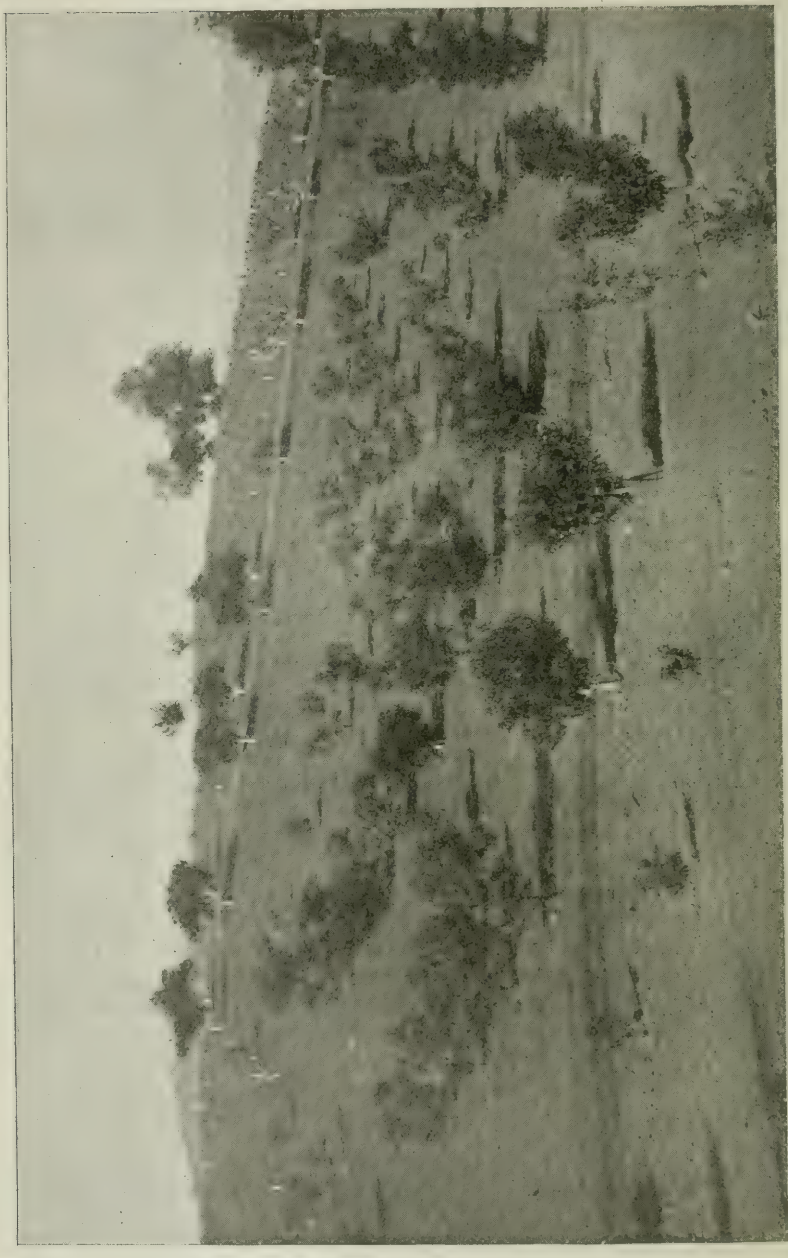


PLATE 25. PART OF STATION TRACT (ON RESERVOIR HILL), FOOTHILL SUBSTATION.

European plums: Coe's Golden, Ive's Autumn, Ontario, Pond's Seedling, Prince Englebert, Victoria, Yellow Sage.

Prunes: Datte d'Hongrie, Hungarian, Petite d'Agen, Robe de Sergent.

The foreman in 1899 recommended the following sorts: Botan, Burbank, Coe's Golden Drop (or Silver Prune), Kelsey, Prince Englebert, Victoria; and for prunes, Petite d'Agen and Robe de Sergent.

Failures have been exceedingly numerous, chiefly from gum disease and lack of adaptation to the locality. The following plums have not done well after eight or ten years of trial: Belgian Purple, Bleecker's Gage, Green Gage, Autumn Gage, Peter's Yellow Gage, Monroe's Gage, Coe's Late Ned, Diaprée Rouge, Early Golden, General Hand, Ive's Autumn, Precoce de Bergthold, Quackenboss, St. Lawrence, Simon, Wangenheim, Wine Sour. The following prunes have failed: Bassford, German, and Holman.

In 1895 the analysis of three seasons' observations showed that seventeen varieties, or 22 per cent of the orchard then in bearing, did poorly and bore little fruit, while eleven other varieties were even more unfit for culture, making a total of twenty-eight varieties, or 36 per cent of the orchard. Thirteen of these trees were on granite soil, and fourteen on slate.

In 1896 there were seventy varieties tabulated. Out of this number eight were barren, and the trees were in poor condition. Thirteen more varieties, none very healthy, lost their blossoms. This gives a total of twenty-one, or 30 per cent of the orchard. A number of varieties bore better than for several preceding years.

In 1897, out of eighty-seven varieties tabulated, thirty-one failed to mature fruit, and four, likewise in poor health, lost their blossoms.

In 1898, notwithstanding the drought, 37 per cent of the plum orchard bore fruit. Some varieties did better than for the preceding years.

In 1899 the percentage of failures was considerably lessened. The success of the plum on slate soil was, as in previous seasons, very marked.

Semitropic and Miscellaneous Fruits.

Figs.—Continued experience shows the great value of the fig orchard to the district. Cuttings have been widely distributed every year in Amador and the adjacent counties. The finer table varieties are most in demand. The successful sorts are almost entirely different from those preferred in the valleys. There is no better point for a grove of wild fig trees, if experiments with the Smyrna fig are to be carried on. The fig needs no irrigation here, and little pruning. Its value as a food-producing tree has seldom been understood in California. We continue to recommend Du Roi, Brown Turkey, Pasteliere, and Hirtu du Japon for the Sierra foothills.

Olives.—The olive trees have done well since last report on this fruit. A number of trees which were too tall, needing stakes, have been cut back so as to carry crops without support. Among these were Picholine, Salonica, and Mission No. 1. The olive requires no irrigation here, but should not be planted on too shallow soil, if fair crops are desired. Some of the olives are shown in the accompanying illustration (plate 26), looking north toward the ditch.

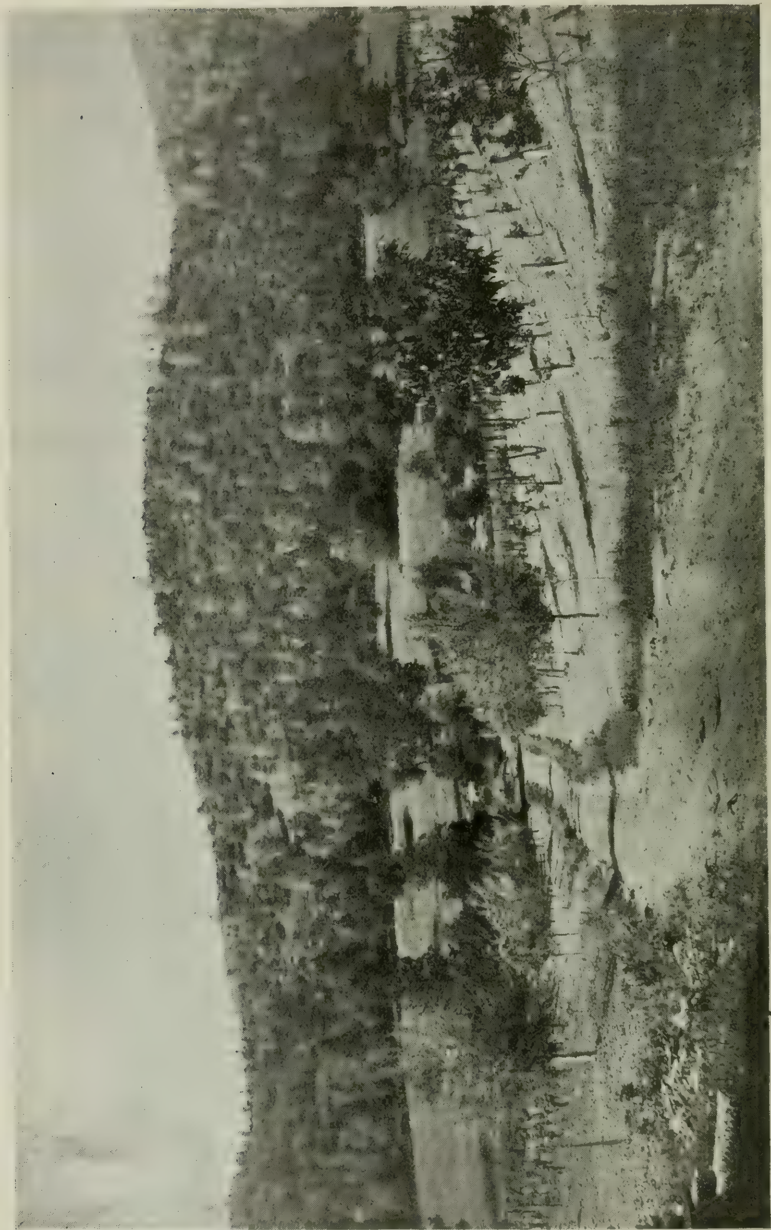


PLATE 26. PART OF FOOTHILL SUBSTATION TRACT, LOOKING NORTH.

The following notes on the leading varieties were sent by the foreman:

Atrorubens.—This variety on slate soil blooms early in May. The crop ripens through the autumn and winter. Some fruit was picked as late as February 15th in 1898. The total yield of first-class fruit in 1897–8 was 40 pounds; in 1898–9, 16 pounds. The tree is very healthy. Late fruit of this variety is likely to be frozen.

Atroviolacea, on red soil near bedrock, for a long time a small and stunted tree and bearing little, is becoming healthier and striking roots in the rock crevices. The crop of 1897 was small, but of good quality; that of 1898 and 1899 was 40 and 32 pounds, respectively.

Macrocarpa, on slate soil, tree twelve feet high, blooms from late April to the end of May. Fruit begins to ripen October 1st, and continues coloring to December 1st. Crop was 25 pounds of first-class fruit in 1897; 9 pounds in 1898, and 56 pounds in 1899.

Mission No. 1 and Mission No. 2, on both slate and granite soils, have been described in previous reports. Those on slate soil are much the best trees, and bear better than those on granite. In 1895 and 1896 both varieties bore crops of from 10 to 15 pounds per tree. In 1897, Mission No. 1 had almost no crop, but Mission No. 2 yielded 30 pounds, which ripened very irregularly; most of it late in the winter. In 1898 and 1899, Mission No. 1 bore very large crops.

Nevadillo Blanco is a fine, thrifty tree, but the crop was short in 1896, 1898, and 1899, and failed entirely in 1897, owing to frosts.

Polymorpha bore a little in 1896, 1898, and 1899. It is a small, slow-growing tree, both on slate and on granite. The crop of 1897 was very light, beginning to turn color in September, and was ripe late in November. Magnificent in appearance; a very large sort.

Redding Picholine.—The tree on slate soil bears heavily every year. The fruit ripens early and remains on the tree, but slightly injured by frost, through the winter.

Præcox.—The yearly crop has varied from 4 to 16 pounds. The quality appears only medium, and the variety is not as yet noticeably early.

Regalis.—This variety usually bears well here. The crop of 1897 was 12 pounds; that of 1898, 28 pounds; and that of 1899, 40 pounds.

Salonica.—This is one of the best varieties here, now averaging about 30 pounds of olives a year, and in 1899, when the tree was twelve years old, it carried 44 pounds of first-class fruit. This variety is of medium earliness and seems worthy of more general planting in the district.

Uvaria.—Like the preceding sort, this variety suits the region. The tree has improved much in the past two years. It is an early and reliable sort. Crop of 1899 was 32 pounds, and the fruit began to color late in September, ripening to black very early in November. The tree attracts as much attention as any olive tree on the grounds. A number of Uvaria seedlings and also crosses with Rubra have been planted, and show many variations in growth.

Walnuts.—The growth of various kinds of walnuts is all that could be desired, but the bearing qualities of the mature trees remain to be tested. The trees are now eight and nine years old, some valley grown, some Sierra grown; some seedlings, others grafted.

Walnuts are in bloom here between April 10th and May 25th, and are unfolding their leaves between April 1st and May 10th. These

dates cover the observed range of ten named varieties and some seedlings for a period of four years. Each variety requires about five days to develop its blooms, and ten days to unfold its leaves.

The most promising variety of English walnut is Bijou, valley-grown stock, grafted on California Black. This ripened September 27th (1897 crop), yielding 20 pounds. It had borne well in 1895 and 1896. In 1898 the crop was but 5 pounds; in 1899 it was 17 pounds.

A seedling English walnut bore 15 pounds in 1897 and again in 1898 and 1899.

Other varieties bearing in 1897, 1898, and 1899 were Persian, Dwarf Prolific, Vourey, Franquette, and Mayette, but none exceeded 12 pounds to the tree.

The California Black (*Juglans Californica*) and the American Black (*J. nigra*) bore, as usual, large crops of about 100 pounds to the tree. Many self-sown seedlings come up every year under these trees, and form excellent stock for nursery use.

The Butternut does not thrive, and the nuts either fall off before ripening, or do not fill well. Another near relative, the Pecan, does not yet thrive here, seeming to require moister land.

Mr. Neal reports that he found grafted trees of a Serotina walnut, a noted variety of *J. regia*, growing and thriving well at five years of age, farther up the Sierra, at an elevation of 4,000 feet. These were grafted on *J. Californica*. Serotina has not yet borne at the station. Walnuts on native stock should be planted more generally throughout the region.

Oranges and Lemons.—Previous reports have pointed out the difficulty of growing these fruits here, and some orange trees sent to the station when it was established have not thriven. But more shelter and better location can now be had, so that another trial is under way. Reasonable success from some late-blooming hardier oranges is likely here. Meanwhile it is gratifying to report that the small Kin-kan or Cumquat orange of Japan, often called the "Gooseberry Orange," grows here and bears large crops without protection. This is a new and very desirable fruit. It is properly grafted upon the hardy *Citrus trifoliata*, and then forms a bush of from six to twelve feet high. Whenever it succeeds no better or more useful ornamental hedge can be had, and single garden specimens are very charming. The market demands for this fruit are large and increasing, for not only is the entire fruit eaten, rind and all, but it is crystallized in sugar and preserved in various ways. Two varieties are known, Nagami and Marumi, the former round, the latter oblong. The variety grown at the station is Nagami. The fruit is deep orange-yellow in color, from half an inch to an inch in diameter, and from an inch to an inch and a half in length.

The *Citrus trifoliata* alluded to can be used as a stock for the best Japanese mandarin oranges, and their culture can be safely extended higher up the Sierras. A few oranges on ordinary citrus stocks are growing at various towns in Amador County, but the culture of citrus fruits is not extending at the present time.

Persimmons.—There is, of course, no doubt of the success of the American persimmon here. It could easily be naturalized in the forests. The Japanese varieties of the fruit continue to be very attractive to the visitor.

STATISTICS OF PERSIMMON CROP FOR 1897.

Variety.	Fruit Reddens.	Fruit Ripe.	Yield.	Number to the Pound.
			lbs.	
Dai Dai Maru	Sept. 30	Nov. 25	50	5
Hyakume	Sept. 30	Nov. 25	50	4½
Kuro Kume	Oct. 3	Nov. 30	20	4
Tsuru Noku	Sept. 25	Nov. 18	45	5½
Yemon	Sept. 25	Nov. 24	10	5
Zeyi Maru	Oct. 1	Dec. 3	40	4½

These trees are small, compact, healthy, hardy, and seem perfectly adapted to the poorest soils here. For several months they make a brilliant display of color, as the fruits will hang on the trees until late in winter. The crop in 1898 was a failure, as the fruit buds were killed by frost. In 1899 the best varieties were Dai Dai Maru, yielding 20 pounds; Kuro Kume, yielding 14 pounds; and Yemon, yielding 12 pounds.

B. SOUTHERN COAST RANGE CULTURE SUBSTATION.

(One and one half miles north-northeast from Paso Robles, San Luis Obispo County. Elevation nearly 800 feet.)

The last volume of Station Reports carried the history of the station to the autumn of 1896. From that period Mr. T. F. Sedgwick was for a time workman in charge, and afterwards acting foreman until his resignation, April 12, 1898. His place was then taken by John H. Ooley as workman in charge until the close of that fiscal year, when John H. Barber was appointed foreman.

There have been several Farmers' Institutes at Paso Robles since the last report was issued, and farmers generally are learning to visit the station more often. During recent years many farmers from Monterey, San Benito, Tulare, Kern, San Luis Obispo, and Santa Barbara counties were at the station. As many as ten actual seekers for information have sometimes presented themselves in a single day.

Interest continues to center in four items: the Persian sheep, crosses of which are being disseminated throughout the district; the experiments with forage plants for arid lands; the problems connected with the deep hardpan soil of the east side of the Salinas; and lastly, the introduction of hardier fruits, capable of enduring to some degree the late spring frosts. These varied needs of a very large area of the Coast Range foothills receive more detailed attention elsewhere in this report.

The importance of the work being done at this substation has become especially evident in recent years. Its results have been positive, as well as negative, the long-continued tests of fruits, forage plants, cereals, and many new crops, and of different methods of farm practice, benefiting farmers and horticulturists in all similar districts. No one of the substations has been better maintained through trying years of drought, and none seem to be more needed, nor better situated for public usefulness.

Rainfall.—While the seasons vary greatly, the average rainfall is sufficient, with careful and thorough cultivation, to produce crops nearly every year, as the following review for the past thirteen years will show any one familiar with California conditions:

RAINFALL FOR THIRTEEN SEASONS.

Season.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Total.
1886-7	.00	.00	.37	.69	.51	6.14	.34	1.10	.44	9.59
1887-8	.00	.21	.60	2.61	5.60	.30	4.50	.20	.28	14.30
1888-9	.01	.00	4.02	2.80	.78	.98	5.55	14.59	1.20	29.93
1889-90	.00	.00	1.69	9.13	6.75	5.40	1.74	.03	.22	24.96
1890-1	.65	.00	.30	3.34	.52	7.27	2.51	1.72	.06	15.72
1891-2	.41	.00	.46	4.09	.00	1.59	3.09	.11	1.55	10.90
1892-3	.00	.46	2.06	5.02	6.00	6.72	4.70	.83	.05	25.84
1893-4	.00	.21	.15	2.03	1.06	.59	.21	.24	1.09	5.58
1894-5	1.13	.33	.09	6.14	6.43	.47	.02	.00	.00	14.61
1895-6	.00	.61	1.53	.55	4.64	.02	3.77	1.25	.77	13.14
1896-7	.00	1.66	1.94	2.48	3.65	4.08	2.88	1.25	.00	17.94
1897-8	.03	.56	.05	.23	.82	1.55	.83	.00	.68	4.75
1898-9	.10	.13	.30	.27	4.16	.08	4.99	1.37	.00	11.40
Average	.18	.32	1.04	3.03	3.14	2.70	2.70	1.73	.48	15.32

In the above table the slight occasional showers in July and August, amounting to only a trace, are disregarded. In June, 1891, the rainfall was .05; in June, 1892, it was .38; and in June, 1894, it was .12; but these late showers are very rare and of little value here.

The total average of the thirteen years is very fair. Only in two seasons has the rainfall been less than 9 inches. The maximum rainfall is close upon 30 inches, and the minimum is 4.75 inches.

This table seems to plainly show that as a rule rains of more than the average in December and January occur in "good years." One exception was 1888–9, and the remarkable rain of April, 1889 (nearly 15 inches) was all that carried this season above the average. In 1898–9 the rains were chiefly in January and March. In 1891 the heavy rains of early February more than made up for the shortcomings of January. Nevertheless, as noted, the character of the season is very often determined by the character of December and January, and this seems especially true for every dry year noted, as whenever the total of the season has fallen below 11 inches, the total of December and January has fallen below 6.32, the average of those months.

Early rains, as in September, often precede poor years. In 1894–5, when the September rains were more than five times the average, and, in fact, were greater than the September rains of eleven other years, there were no rains, except a "trace," in March, April, and May. Hence, though the season's total was nearly up to the average, the crops were very short. Both of the two other seasons in which there was an appreciable amount of rain in September, were years of little or no rains in January, and of less than average late rains.

The Climate Before 1886–7.—The recollections of prominent and successful farmers and stock-raisers respecting the rainfall in the district before accurate records were kept, are entitled to much weight, enforced as they usually are by more or less documentary evidence. The old stockmen agree that 1861–2 was very wet indeed, and that the rivers washed away more land that season than at any time since.

1862–3 was "a very good year" for grass on the east side of the Salinas.

1863–4 was very dry indeed—one of the worst up to that date in the recollection of the pioneers. Then followed five years of fair average rains that would have given good wheat crops had the plains been farmed.

1870–1 was a year of light rains. It was "dry to medium dry" and cold, with very severe winds.

Mr. J. M. Jones, of the great Carrisa ranch, furnishes the above data on seasons between 1861 and 1871. Between 1871 and 1875 the seasons were neither extremely dry nor extremely wet.

Mr. M. Gerst, a well-known and successful farmer, came to California in 1875. He reports as follows:

1875–6 was wet to very wet. Stubble on the Estrella was two feet high.

1876–7 was "dry and cold." Other pioneers say the rainfall varied from three inches inland to eight inches near the coast.

1877–8 was a very good season. Dry autumn, but wet spring. Grain stood six feet high, and in many places it rusted.

1878–9 was an average year; 1879–80, wet and warm; 1880–1 and 1881–2 were both average seasons.

Mr. Clift, one of the leading farmers of the east side, began his notes in 1882–3. That season was "dry, very dry, with cold and violent northers."

1883–4 was a dry autumn; wet and warm spring; very fine crops.

1884–5 and 1885–6 were good average years. (Mr. Levi Exline's records give 8 inches of rain in November, 1885, and 11 inches in January, 1886.)

1886–7 (recorded in previous table) was a year of small rainfall, considerably below the average, and it was cold with many severe northers. (The actual rainfall of 9.59 inches was nearly 6 inches below the average.)

Comparing all these available data respecting the rainfall of the district since 1861, we find the following tabulation is approved by the old farmers and confirmed by the records:

Dry and very dry years: 1863–4, 1870–1, 1882–3, 1886–7, 1893–4, 1897–8.

Wet and very wet years: 1861–2, 1875–6, 1877–8, 1879–80, 1883–4, 1888–9, 1889–90, 1892–3.

Here we have in thirty-seven consecutive years six seasons reported as "dry to very dry" by good, practical, and successful farmers, who are accustomed to make the most of every rainfall. They report eight as wet years, and twenty as average. Some of them state that the very dry years were only five in number.

Utilization of Rainfall.—The experience of about forty years in this country shows that skill and energy are necessary to utilize anything like the full rainfall. In practice unskilled farmers lose from a third to a half of the registered rainfall received. Profitable hay and grain crops have been made with only eight inches of rain, and orchards have been kept alive and growing with only five inches. The conservation of moisture in the semi-arid belt, under proper cultivation, is one of the most important of agricultural facts, and can hardly be understood in regions of summer rains. The entire root-system of plants is modified, descending as deeply as possible, not spreading out on the surface.

Frosts.—The early frosts and late frosts, which sometimes cut short the growing season of crops otherwise adapted to the climate, have seldom ranged below 18°, but some still greater extremes have been recorded. According to the railroad record at Paso Robles, fruit was destroyed by late frosts in 1886, 1887, and 1888; the lowest temperature of these three springs was 13° Fahr. According to station records there was a good fruit crop in 1890, 1892, and 1896. Fruit was more or less injured by frost in all other years between 1888 and 1899. The severe late frosts of March and April follow after many warm days which occur in spring and unduly force vegetable growth. If the temperature falls below 32° after fruit blossoms are out, not only almonds and apricots, but most of the cherries and many peaches, and both Oriental and European plums, are likely to be destroyed for the season. The total number of killing frosts for 1898–9 was 28.

Temperature.—The statistics of the station since July, 1892, have been tabulated so as to show means, maximums, minimums, and daily

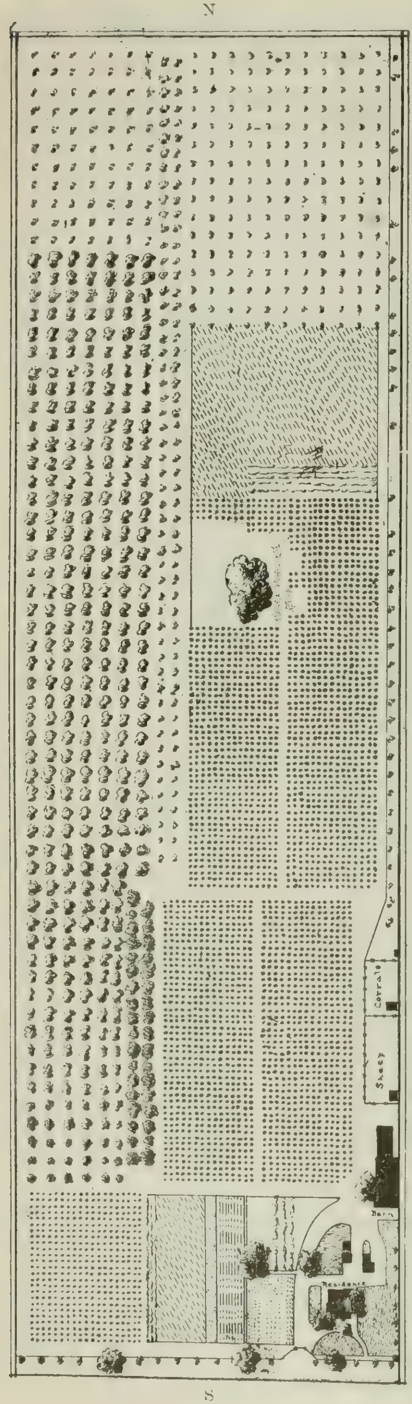
range, to July, 1899, thus covering seven full years, a period long enough to fairly show the normal temperature of the district.

TEMPERATURE STATISTICS, 1895–99.

Month.	Daily Mean.	Mean Daily Maximum	Mean Daily Minimum	Mean Daily Range	Extreme Maximum, and Dates.	Extreme Minimum, and Dates.
1895—July	67.96°	85.51°	50.29°	35.22°	99° 23d	45° 4th
August	68.77	86.74	51.00	35.74	102 4th, 5th	43 28th
September	63.23	81.10	46.30	34.80	91 26th, 28th	33 23d
October	61.12	75.80	45.41	30.66	91 1st	35 31st
November	47.30	61.83	32.83	29.00	76 19th	18 24th
December	41.87	53.61	30.09	23.51	64 5th, 11th, 12th	20 30th
1896—January	46.70	56.87	36.48	20.38	62 7th, 9th, 21st	21 1st
February	48.58	62.96	33.65	29.00	72 18th, 23d, 24th	26 7th, 8th
March	51.96	62.64	41.29	21.29	74 18th, 23d, 24th	26 1st
April	49.76	60.13	38.70	21.33	69 13th	28 16th, 20th
May	58.03	71.83	44.58	27.03	94 26th	36 6th
June	68.43	86.86	50.03	36.83	102 15th, 16th	40 3d
July	75.77	92.29	66.16	26.12	106 11th	57 28th, 29th
August	75.38	90.41	61.51	29.00	99 1st	56 24th
September	67.23	80.83	55.26	26.51	92 5th	48 20th
October	60.48	75.64	48.54	28.67	96 2d, 3d	41 2d
November	50.46	60.50	40.36	23.46	70 8th, 9th	29 30th
December	47.25	57.32	36.38	20.93	69 20th	30 7th, 20th
1897—January	46.38	55.80	37.22	19.22	64 22d	28 3d
February	47.92	56.75	40.00	17.46	70 26th	31 23d
March	47.09	56.00	38.00	18.29	69 24th	33 14th
April	58.56	65.63	45.33	27.53	83 16th	40 2d
May	61.48	77.29	48.68	25.54	86 10th	40 6th
June	68.90	77.43	57.06	20.70	94 5th	52 14th, 15th
July	70.00	86.71	54.58	31.38	101 12th	46 7th, 23d
August	71.12	86.54	56.67	31.09	102 21st	47 4th
September	66.46	84.00	48.00	36.00	93 18th	42 11th
October	57.35	69.32	45.70	22.77	84 4th	36 28th
November	50.43	64.23	38.66	25.70	74 19th	26 16th, 27th
December	43.96	58.29	28.61	28.45	69 30th	16 24th
1898—January	37.38	54.67	31.29	24.51	65 1st	24 11th
February	49.82	61.14	38.17	21.17	73 14th	31 22d
March	48.83	62.38	36.03	26.03	76 8th	26 19th, 24th
April	55.86	72.50	39.36	32.40	97 25th	33 10th
May	59.00	77.00	41.00	35.00	96 8th	36 8th, 10th, 26th
June	67.00	91.00	43.00	48.00	105 18th	36 6th
July	66.00	92.00	40.00	52.00	112 26th	34 21st
August	66.00	91.00	42.00	49.00	112 12th	34 17th
September	66.00	88.00	43.00	45.00	108 11th	33 6th
October	61.00	77.00	46.00	30.00	89 13th	38 26th
November	50.00	66.00	34.00	32.00	81 5th, 6th	22 26th
December	45.00	59.00	31.00	28.00	68 3d	20 12th, 31st
1899—January	49.00	59.00	39.00	20.00	71 30th	28 1st
February	49.00	64.00	35.00	29.00	77 19th	20 6th
March	52.00	63.00	42.00	21.00	81 6th	30 10th, 11th
April	56.00	69.00	43.00	26.00	82 8th	35 23d
May	57.00	70.00	43.00	27.00	87 11th	37 2d, 16th, 24th
June	68.00	84.00	51.00	33.00	97 30th	41 2d

This comprehensive view of so many successive seasons shows the extreme maximum to have been 112° (in July and August, 1898), and the extreme minimum to have been 16° (in December, 1897). But, as previously noted, the thermometer has fallen in the immediate district to 13°, though it has never risen, so far as recorded, above 112°. The limitations upon vegetable growth imposed by this climate are chiefly shown by the maximums and minimums of February, March, and April.

The accompanying chart, made in 1897–8 by Mr. Williams, for some time a workman at this substation, remains accurate at the present time, excepting that a large part of the old orchard at the southern end has now been removed and is partly sown to Australian saltbush and other forage plants. The extent of ground devoted to vineyard has also been reduced. This chart can be compared with that on page 104, of the Report of this station for 1888–9.



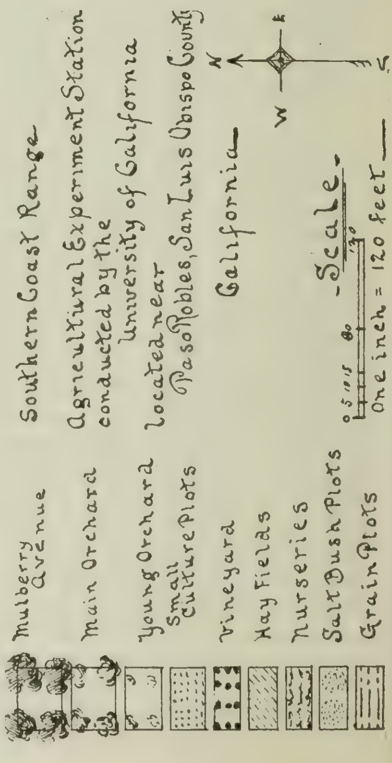


Chart of Southern Coast Range Substation in 1897–8.

THE ORCHARD.

The new apple and pear orchard planted in the spring of 1897 promises to become a credit to the station. The older parts of the main orchard, planted south of the swale, on shallow and poor soil, in 1889, are being removed and the ground blasted and fertilized. This portion includes some cherries, almonds, apples, peaches, and plums. Many of the varieties are duplicated on better soil. The severe drought and late frosts of 1898 destroyed most of the fruit crop of that season. There was a fair crop of grapes, apples, and pears in 1899.

Pome Fruits.

Apples.—There was a good crop of some varieties in 1895 when the orchard was coming into bearing. In 1896, very severe late frosts destroyed the fruit. Quite a crop of some varieties was gathered in 1897, ranging from five to forty pounds to a tree, but as the bearing trees were on shallow hardpan, and the soil lacked nutriment, the crop was small, and the fruit in most cases was inferior in size and quality.

The trees in 1897 were in blossom between April 5th and April 25th, and were unfolding their leaves from March 22d to May 1st. It was a somewhat late season, and all varieties escaped the spring frosts. As the crop ripened, the fruit of many varieties showed sunburn, some to such an extent as to be nearly or quite worthless, and some rotted at the core. These troubles seem to have been chiefly due to the lack of sufficient nutrition; the trees were stunted, unhealthy, and comparatively leafless. Vor, one of the Russian varieties, rotted quite as badly as any. Keswick Codlin, Skinner's Seedling, Marshall, Arkansas Black, Colvert, and Dickinson were entirely free from both these troubles.

There are few early varieties as yet in bearing at the station, but Shannon and Early Ripe are ready for table use early in July. Astrachan has not been so early, hardly coming in before the last week in July, and is almost immediately followed by such late summer varieties as Gravenstein, Keswick Codlin, and Maiden's Blush. Among the earliest apples in the orchard are some of the crabs. Transcendent has been ripe by July 10th (in 1895), but its range is from that date to July 24th. The quality of this crab is excellent here, but Siberian is worthless. Keswick Codlin is the best apple in the above list, but it is properly an August apple.

The September or early autumn apples are numerous here, including many that elsewhere rank as late autumn or even as early winter sorts. Fall Pippin and Alexander ripen with Maiden's Blush, the first week in September, or sometimes even on September 1st. Acme and Haas are as early, but the latter rots on the trees. In 1895, Fameuse, White Bellflower, and Swaar, which are elsewhere winter apples, ripened in September. In 1897 Swaar ripened toward the end of October. The best of the regular September apples here is Fall Pippin. Maiden's Blush is not up to its usual average. Fameuse, Swaar, and White Bellflower, whether September or October varieties, are of fair size and quality. Alexander sunburns badly, as it often does even in the Santa Clara Valley. The trees must be pruned for leaf-protection, with even more than usual care. Very light pruning gives best results. Arabskoe is another Russian apple that can be recommended as a good red September

apple here. The pippins seem to do well (Skinner's Seedling belongs to this class), and the Golden Pippin, Holland Pippin, and others suit the district.

The main apple crop here comes in October. In this month, 1895, the varieties ripened in the order named: Wagener, Rhode Island Greening, Missouri Pippin, English Golden Russet, Winesap, White Winter Pearmain, Yellow Newtown Pippin, and Vandevere. The last five of this list would have kept later than the end of October, but they were in fair eating condition by October 20th. In 1897 the October apples were Fameuse, Wagener, Swaar, Missouri Pippin, Ben Davis, English Golden Russet, Red Cheek Pippin, Shackleford, Arkansas Black, Colvert, and Dickinson, and all were in fair eating condition by October 20th. These lists show nine or ten varieties out of the sixteen named that are elsewhere classified as winter apples.

It is very difficult to see where the really late keepers are to come from, unless we take Ribston Pippin, French Crab, Court Pendu Plat, the noted "Iron Apple" of Herefordshire, and such varieties as these. In 1897 the two latest were Rome Beauty and Shirley, which may be said to carry the season toward December 1st. They outlasted Yellow Newtown Pippin. But soil and the condition of the trees have much to do with the early maturity and keeping qualities of fruits, and the standard late apples, such as White Winter Pearmain and Yellow Newtown Pippin, are good keepers grown elsewhere in this district. The newly planted orchard on adobe land should materially change this abnormal "hardpan" record.

The frosts of March and April, 1898 (lowest temperature, 24° Fahr.), destroyed much of the apple crop. Several of the crab-apples escaped, and a good many varieties bore a few apples to the tree. Among these were Alexander, Stump, Porter, and Red-Cheek Pippin.

Pears.—The pear orchard continues to give promise of great usefulness to the district, though experience shows that the pears, like the apples, ripen in a manner that must surprise all the pomological authorities. Some varieties are unduly retarded in their maturing season, while others are stimulated. As a rule, however, no very early nor very late fruit seems likely to be obtained here.

Among the summer varieties Madeleine was not in bearing until 1898, and Doyenne d'Ete lost its fruit in 1897. But Beurré d'Amanlis, which is usually rated as a summer pear, did not ripen in 1897 till October 7th. Its fruit (10 pounds) was gathered September 29th. On the other hand, Brockworth Park, usually a fine mid-autumn pear, was gathered on August 10th, and ripened before the end of that month. Le Conte was picked September 29th (crop of 34 pounds) and ripened October 10th; Seckel, an earlier pear than Le Conte in other districts, was fully ripe by October 1st. Variations of this kind show that the district must be measured by its own standards, and that the ordinary "succession lists" made by nurserymen and fruit-growers in other parts of the State, will never suit Paso Robles.

Bartlett, the leading variety of market pear, ranking usually as a summer variety (or in some districts, such as Newcastle, as almost an early summer sort), is here a mid-autumn pear. Picked September 29, 1897, Bartletts ripened fit for table use by October 7th. It seems likely that the district can furnish Bartletts in good condition as late as

October 15th, which would certainly justify large planting for shipment to Eastern markets.

Coming to the generally accepted autumnal varieties, we find even more variation from accepted pomological lists. The following varieties will show the leading varieties that ripened in Paso Robles in 1897 before November 1st. They are arranged in the order of their ripening at the station, and compared with the standard catalogues elsewhere. Bartlett is also tabulated, for comparison with other varieties.

AUTUMN PEARS FOR 1897.

Variety.	Gathered.	Ripe.	Crop.	Quality.	Season Elsewhere.
			lbs.		
Souvenir d'Esperen	Aug. 17	Sept. 6	20	Good	Late Autumn.
Seckel	Sept. 27	Oct. 1	10	Poor	Autumn.
Howell	Sept. 29	Oct. 1	32	Good	Autumn.
Flemish Beauty	Sept. 29	Oct. 7	25	Fair	Autumn.
Bartlett	Sept. 29	Oct. 7	20	Good	Summer.
Forelle	Sept. 29	Oct. 7	20	Good	Winter.
Beurré superfin	Sept. 29	Oct. 10	15	Fair	Autumn.
Idaho	Sept. 29	Oct. 10	26	Good	Late Autumn.
Beurré d'Anjou	Sept. 28	Oct. 15	20	Very good	Autumn.
Onondaga	Sept. 29	Oct. 15	10	Good	Autumn.
Lawrence	Sept. 29	Oct. 15	44	Good	Autumn.
White Doyenne	Sept. 29	Oct. 16	25	Fair	Autumn.
Columbia	Sept. 29	Oct. 18	30	Good	Autumn.
Kennedy	Sept. 29	Oct. 20	20	Very poor	Winter.
Counseiller de la Cour	Sept. 29	Oct. 20	25	Acidulous	Winter.
Beurré gris d' Hiver	Sept. 29	Oct. 20	19	Fair	Winter.
Louise Bonne de Jersey	Oct. 7	Oct. 25	6	Poor	Autumn.
Frederick Clapp	Oct. 7	Oct. 25	34	Very good	Autumn.
Beurré Diel	Oct. 7	Oct. 25	4	Fair	Autumn.
Doyenne du Comice	Oct. 7	Oct. 26	1	Good	Autumn.
Gray Doyenne	Oct. 7	Oct. 26	10	Fair	Autumn.

The foregoing observations agree with those made in other years. It is therefore likely that the climatic conditions that produced such notable changes in the ordinary ripening periods are usual, or at least frequent, in this district. By "season elsewhere" is meant, in this case, that in the Bay counties, and also, as far as information goes, in the Sacramento Valley, as well as at our other Experiment Stations, the pears listed normally ripen as noted in said column. Bartlett is usually a summer pear, Flemish Beauty is an autumn pear, Forelle is an early winter pear; from the first ripe Bartlett to the last ripe Forelle in the Bay counties is an interval of at least four full months. At Paso Robles all three ripened the first week in October, and rank as middle autumn varieties.

The most important practical question suggested is this: What varieties of winter pears planted at Paso Robles will remain winter varieties, carrying the pear season to January, February, and March? If such varieties as P. Barry, Doyenne d'Alençon, and Easter Beurré do not here retain their normal keeping qualities, the prospect of finding any reliable late pear will be poor indeed.

Quinces.—Former reports have noted the failure of the quinces on the lighter soils of the station, but trees of Missouri Mammoth and Bourgeat have made excellent growth in nursery and should ultimately improve the record. These are on the heavier soil of the swale. They are grafted varieties, on Angers stock, which is noticeably more vigorous than stocks from cuttings of the common Orange or Apple quince.

Stone Fruits.

The season of 1897 was favorable to the stone fruits, and an excellent crop was obtained, especially in the case of peaches, nectarines, and plums. Apricots suffered from late frosts, and the climate seems ill-adapted to the growth of cherries. In 1898 and 1899 there were very light crops of apricots, peaches, plums, and nectarines.

Almonds.—The culture of none of the stone fruits has been so discouraging as that of almonds. In 1893, I X L, Paper-shell, Sultana, King's Soft-shell, and Languedoc bore crops of fair size, considering the age of the trees. Since then no almonds have been obtained, except a few scattering ones in the tops of the trees, until in 1897. I X L then bore fifteen pounds; Paper-shell, ten; Nonpareil, fifteen; Drake's Seedling, eight; Languedoc, eighteen; and some of the other varieties had from one to five pounds each. This, for trees nine years old, which are among the largest trees in the orchard, is certainly not tempting to an investor. The almonds have bloomed (for five years past) between February 10th and March 25th. Spring frosts are likely to occur between February 1st and April 1st. It seems evident that money spent on almond orchards in this and similar localities will be wasted, as every variety obtainable in California has been given a trial here.

Apricots.—Another year's experiment emphasizes the uselessness of planting apricots on these high rolling plains, unless local conditions are very favorable. Twenty-one varieties which blossomed in 1894 and 1895, lost their fruit both years, and there was practically no crop. In 1896 the frosts were even more severe. In 1897 some fruit was obtained from Moorpark, Routier's, Peach, Luizet, Smith's Triumph, Blenheim, Kaisha, Large Early, Montgamet, Royal, and Beauge. No tree bore more than six pounds. In size and quality the fruits were first class. The earliest of the season was Luizet, ripening July 8th; and the latest was Moorpark, July 23d. The trees blossomed heavily between March 1st and March 25th. Better results can be hoped for from a collection of Russian and other hardy apricots now in nursery, but it seems useless to plant the ordinary varieties of commerce.

Nectarines.—This very interesting fruit is fairly well adapted to the region, if care be taken to select the best varieties. Six kinds began to bear in 1893, and nine are now bearing. The best nectarines, as shown by five years' testing, is the Victoria. This is a fine, large, white nectarine, which in ordinary seasons bears as well as any peach, the crop having been from forty to one hundred pounds. The blossoming season is especially long, often thirty or forty days, so that it escapes in some measure the spring frosts. The fruits ripen from August 25th to September 15th. Another very fine nectarine is Newington, which bears nearly as well as Victoria, and ripens from ten to twelve days earlier.

Peaches.—The district is excellent for peaches, at least four years out of five, but late frosts sometimes destroy the crop, and droughts injure the trees. It is necessary to renew the tops with much care, as the peach, nowhere a long-lived tree, is subject here to a dry soil and trying climate. The quality of the fruit is often remarkably good, and the trees show very little curl-leaf.

The varieties of peaches at this station were very fully described on pages 385–391 of the Report for 1894–5.

The yellow clings have usually done better here than the white or tinted clings. They are rich in color and fine in quality, but not large as compared with the majority of valley-grown clings. In this respect, however, they rank better than unirrigated mountain peaches.

The freestone peaches have suffered in a number of instances from late frosts. Some were very fine in size and quality—better in fact than the clings. The very early peaches of the half-cling Alexander type were large, of high color, and would rank well in any part of California. Ripening so early, there was moisture enough retained in the soil to perfect them. The later varieties were often lacking in juice, though sweet and well colored.

Cherries.—Complete notes on cherries have not been published since the Report for 1895, for frosts destroyed the crop of 1896. Cherries here are of such excellent quality that the uncertainty of seasons is much to be regretted. Experience indicates a sheltered slope (not southern) and good soil, as necessary to success. The trunks need protection from the sun until fully shaded by the boughs. There must be many places in the region where the cherries will thrive under such conditions. On the light soil of the station tract cherries have never done well enough to justify their culture commercially, and the introduction of ironclad varieties now seems the only hope. Quite a number of trees have failed and been removed from the orchard since 1895.

Plums and Prunes.—The only important modification of former reports respecting plums and prunes that is indicated by the experience of 1897–9, is that the Oriental types are again doing better than any other class, both in quality and fruitfulness. The best four out of some thirty-five varieties bearing were Burbank, Kelsey, Botankio, and Imperial Gage, and no other variety of either plum or prune approached them in size of crop. The Myrobalan plums bear large crops nearly every year, and the behavior of new American plums, especially Milton and Hammer, which have set fruit abundantly, even in nursery, shows that better-bearing plums can be secured for this district.

SEMITROPIC AND MISCELLANEOUS FRUITS.

Figs.—A few varieties stand the climate sufficiently to indicate that some portions of the district are adapted to this tree, which puts forth its foliage so late in the spring as to escape many severe frosts. In 1897, Agen bore fifteen pounds, ripe about September 25th, and later. Black Bourjassotte, Black California, Black Marseilles, Dorée Narbus, and Pastiliere have borne fairly well here. The spring frosts of 1898 were very severe upon fig trees, and none are now grown at the station.

Olives.—In 1892, 1893, and 1894 the olive trees did quite well, and Oblonga, Præcox, Picholine, and other varieties bore crops. Severe late frosts in 1894, 1895, and 1896 killed much of the new wood, and severely injured all the trees. The future of olive culture in this district east of the Salinas is not yet decided, but the chances are much against it. We have tested nearly all the leading varieties here, and have a number of seedlings not yet of bearing age.

Mulberries.—Notwithstanding the occasional loss of the first crop of leaves by late spring frosts, the value of the mulberry here is generally recognized. Not only is the fruit useful, but sheep, goats, hogs, and

cattle will eat the leaves, small twigs, and bark, so that in seasons of drought a mulberry plantation might be of considerable service. All the mulberries stand on very poor and shallow soil.

Alba bears crops of from fifty to eighty pounds each year, but the fruit is useful only for chickens or hogs. Lhoo bears a large and excellent fruit, and the trees carry from twenty-five to seventy-five pounds apiece. Nagasaki and Persian also bear well, and the fruit is excellent. Russian and Moretti bear but poorly. The fruit season of the mulberries here ranges from May 20th to July 1st. As a rule, the mulberries seem to ripen about ten days later here than the same variety at Chico, which is more than three hundred miles farther north.

CEREALS, FORAGE PLANTS, ETC.

During 1897 the foreman made a collection of sample kernels, of 216 different varieties of wheats, barleys, ryes, and other cereals. These were put up in two-ounce bottles, labeled and catalogued. Every variety included in this collection has been grown at the station, and it forms a very interesting exhibit. A similar, though less extensive, collection has been made for the Board of Trade. Sheaves and samples of grain grown at the station have been shown in San Luis Obispo, in Salinas City, and in San Francisco, as well as in Paso Robles.

Cereals in 1898.—The drilled grain plots were not planted until January, and therefore received less than 3½ inches of rain. When inspected, March 3d, they were still green and growing, but evidently could not long so continue. April 12th all were dying, and twenty selected plots were irrigated, receiving the equivalent of one more inch of rain, were hoed, and at once took a new start. The following notes were taken in May of that year:

Barleys: Kahala, Nab-el-Bel, Bidi, and Adjumo, all from Algiers, were from 22 to 30 inches in height when headed out. They began to head from May 2d to May 4th. They are well filled, making good hay, and seem to stand the drought much better than most common barleys, which grew to only 16 inches and are in bad condition. The new Algerian barleys should, therefore, be tested on a larger scale in this district.

Wheats: Alpha, from Canada, did badly; it was 18 inches high May 10th, when headed, and the heads were small and not filled well. White Naples crossed with King's Jubilee, height 28 inches when headed, May 4th, is a much better wheat than Alpha. Harris, headed May 6th, is also fair. The best wheat of ten varieties receiving one irrigation, as noted, was Northern Champion, which headed May 7th; May 28th it stood only 19 inches high, but was compact, with dark leaves and well-filled heads from 5 to 6 inches long. This wheat deserves high praise.

The Saltbushes.—It now seems certain from three years of experiments here that the saltbushes can be made to add immensely to the value of grazing lands of the southern Coast Range. The species being tested are *Atriplex semibaccata*, *A. leptocarpa*, *A. visicaria*, and *A. halimoides*. The following observations were made in the dry summer of 1898, and the plots were on a sufficient scale to satisfy every farmer of the ease and rapidity of growth of these plants. See plates, pages 299, 300.

Atriplex semibaccata: This species, so successful on alkaline soils, proves very valuable here, even on the poorest lands, as, though of less rapid growth than in Tulare, it keeps green all summer and is greedily eaten by all cattle and most horses. "As good as alfalfa" is what the farmers who have tried it report to the Department, and our own tests show that horses, cattle, and sheep need little other food. This species was first planted at the station in 1896. There are now plants of one, two, and three years of age, as well as larger plots sown in the winter of 1897, and again in 1898–9. Gophers are not particularly fond of it, but in a dry season will, of course, eat anything green.

The roots of the oldest plants are now an inch in diameter and in most cases descend through the soil well through the hardpan. The plants made a foot of growth between February 1st and April 12th, and being cut back made a second growth of six inches by the end of May, 1898, (total rainfall, 4.75 inches). The ground was cultivated but once between the clumps. The ground is covered with seedlings.

The plants of two years of age have also covered the ground, being planted in four-foot rows. Some were cultivated, others were not. All are green and healthy, with new growth of from six to twelve inches. Thousands of volunteer seedlings have sprung up in all the plots.

On March 3d, one hundred small seedlings were pulled up and transplanted, pinching back the tops. These plants were watered once, and shaded for forty-eight hours, and eighty-five per cent grew. The test was a hard one, as all the earth was shaken from the roots, and at the end of forty-eight hours the plants were exposed to the full sunlight. The station will probably be able to distribute many thousands of such seedlings every spring after this to those who apply for them and will agree to report results. Fifty such plants properly cared for should give a farmer in the first season sufficient seed to sow several acres of ground.

Several plots of the poorest soil on the station were sown to saltbush in December, 1897, but the main planting was not done until January, 1898. On April 12, 1898, these plots were apparently dying. The average plants were then from one to two inches high, with single roots two or three inches deep in the dry soil, which, since the seed was sown, had received less than 3½ inches of rain. These plots were then given, by measurement, water equivalent to one inch of rain, and were thinned and hoed. May 28th, the average plants were eight to nine inches high, and some were twelve inches. The roots had descended from ten to eighteen inches. The plants had also tillered to such an extent that from six to fifteen branches of succulent growth were found springing from single roots. No more water was given during the entire summer.

Mr. John H. Barber, the present foreman of the station, reports that "close upon one hundred pounds of seed was gathered from one fifth of an acre of *A. semibaccata* during the season of 1898." At the end of September the plot was cut over, close to the ground, and the fodder cured like hay. The dry fodder from one half the plot was then weighed, and the yield of hay found to be at the rate of one and a half tons per acre. What other plant would give such a yield, on such soil, in such a season of drought! "As soon as cut-over, the plants began to put forth new shoots, and by December 31st had made quite a respectable growth, though the rainfall during the three months was prac-

tically nothing, merely a few light showers, which scarcely moistened the surface of the parched earth."

Investigation showed that the taproots of the saltbush had penetrated the hardpan and pierced right through its four or five feet of thickness in search of moisture to support the vigorous growth of the plants (see plate 13, p. 73). The roots were followed down in several cases six to seven feet in the soil. With the copious rains of January, 1899, thousands of volunteer seedlings sprang up among and about the older plants, but they were not needed, as the new growth of the original plants speedily covered the ground."

Mr. Barber reports that the present area planted to saltbushes (1899), chiefly *Atriplex semibaccata*, is about two acres. This also includes large plots of *halimoides* and *leptocarpa*, with small trial plots of other species.

His advice about propagation in this district is as follows: "Seed may be sown with fall or spring rains; not in cold weather, as it does not then germinate readily. I recommend fall planting, as then the plants become well established in the ground before the dry season sets in, and, under ordinary conditions, will make sufficient growth to be pastured or cut-over early in the summer. The soil should be well plowed and harrowed before planting. Seed may be broadcasted, or sown in rows with garden drill. It should not be covered or drilled in, but simply dropped on the surface. If garden drill is used, the seed may be pressed in with the light roller usually accompanying such tools. It is best to sow just before a rain; then if the ground is warm, as in autumn or spring, the seed will sprout in a few days. If sown broadcast on a large scale, the cost of planting should be about the same as for alfalfa, with the addition of any difference in the cost of seed. If the ground is thoroughly prepared and seed is sown at the right time, no difficulty should be experienced in obtaining a good stand by this means. The use of a roller to firm seeds into the soil, or of a harrow to break crust after plants are up, may be necessary. Individual judgment, based on experience with the particular soil, must guide here. If sown with a garden drill, one man can easily sow about three acres a day, in rows three feet apart. Raising in boxes and transplanting to field may be resorted to, to insure a stand under doubtful conditions. Mr. Levi Exline set his plants in rows about three feet apart, and the plants about eighteen inches apart in the row. With ground in perfect condition, one man transplanted about one third of an acre per day. No water was used in transplanting, but it was done just before a rain. He planted about three acres, and got a good stand."

In 1899 seed of Australian saltbush was again widely distributed, and has now been planted by many of the stockmen in the eastern part of San Luis Obispo and Monterey counties.

HARDPAN INVESTIGATIONS.

Probing to ascertain the depth of soil began in 1897 and has been continued at intervals until the greater part of the tract is now mapped out. A pointed steel rod thrust into the soil, gives very distinct evidence by the "feel" and vibration when it strikes hardpan. Some errors were discovered subsequent to the probings early in 1897, and the charts are being corrected. Where there seems to be any doubt the spade is used. The probes were made fifty feet apart, in rows the same

distance from each other. Some of these squares are now to be taken and probed into smaller divisions.

Probing began at the southwest corner, fifty feet from the fence. There the distance to hardpan is three feet eight inches. The least depth found was one foot three inches, and the greatest was five feet. Three feet is about the average. The depressions in the surface of the hardpan are never abrupt, but rounded and gentle. The actual thickness of hardpan to the coarse sand below, varies from three to six feet, so far as ascertained by digging.

A photograph taken of a peach root on the hardpan is shown in plate 3, on page 45.

Trees Removed.—In April and May, 1897, fifty-eight fruit trees were taken out of the orchard because they had been unable to penetrate the hardpan and were dead or dying. (See plate 3.) The list included fifteen peaches, six cherries, eight apples, twenty plums, eight apricots, and one fig. Probes taken beneath these trees showed the distance to hardpan to range from one foot six inches, to four feet. In October, 1898, another lot of seventy-three trees was taken out, and as these had been on even poorer and very shallow soil the results were very instructive. Every place was probed, bringing the measurements of depth to sixteen feet apart. These trees were chiefly cherries and apples, with a few almonds. The depth of soil varied from eighteen to twenty-six inches, in no place exceeding the latter. In this soil native oaks, English oaks, mulberries, and a few almonds were the only species of trees that seemed able to penetrate the hardpan and to thrive continuously. The Persian mulberry bears good crops of fruit under these conditions.

After clearing this land, it was blasted, shattering the hardpan sufficiently, it is hoped, for future tree-tests, though it may "run together" again. A portion was well fertilized and the entire plot was sown to hay, excepting that some specimen trees have now been planted here to ascertain whether their growth upon such hardpan, after blasting had been resorted to, is better than formerly.

There have been very considerable losses incurred by farmers in attempts to plant orchards on such hardpan lands as these. The experience of the station is that by no amount of care can an orchard be permanently established upon such soil without blasting deeply and fertilizing heavily. As noted elsewhere, this is land adapted in its natural condition to saltbushes and similar plants.

Moisture in the Soils.—During the extreme drought of the summer of 1898, the tests made upon these hardpan soils by Professor R. H. Loughridge showed that uncultivated soil contained 2.6 per cent of moisture, and that the cultivated orchard soil from which trees have not been removed contained 3.3 per cent. With the same rainfall, the cultivated adobe soils (not in any sense hardpan soils) at the north end of the tract, where the new apple and pear orchards are now planted, contain the enormous percentages of 12.3 and 16.1. All these moisture-tests were taken to the depth of eight feet. The trees in the new orchard on the adobe made growths of from twenty to twenty-six inches. Those trees upon the sandy hardpan that were not taken out, made growths of from four to ten inches, excepting in cases where cut back heavily, when, of course, they made a strong growth of two and three feet.

C. SAN JOAQUIN VALLEY CULTURE SUBSTATION.

(One mile southeast of Tulare City, Tulare County. Elevation of Station, 282 feet.)

Since the last report was written, the work of reclamation of alkali spots on the station has been continued. The entire tract, and also a large area of adjacent country, have been mapped out, and the destruction of "strong alkali" has been studied. More complete analyses of results, and discussion of problems involved, will appear in a later report.

The actual reclamation of the worst spots of alkali on the station has again been accomplished in practice, during the past year (as elsewhere shown), but the very dry seasons of 1897–8, 1898–9, and 1899–1900 have prevented the exhibition of results on a large scale, as only small areas could be irrigated sufficiently to make crops.

Strong alkali shows on the main avenue, between the vineyard and the orchard, and many of the fig trees have perished here. The accompanying photograph (plate 27), which was taken in 1898 facing west, toward the house, shows this plainly, and includes one of the poorest parts of both orchard and vineyard. The borders of saltbush appear on both sides of the avenue.

The vineyard continues to give remarkable results, both in quantity and in quality, illustrating the peculiar value of these soils, when not too strongly impregnated with carbonate of soda, for the production of especially fine grapes of certain varieties.

Recognition of the growing importance of this Experiment Substation and of its local value comes from all directions, and visitors from Tulare, Kern, Fresno, Kings, and other counties increase in number every year.

Local Management.—Mr. John Twohy has been continued as Patron; Mr. Julius Forrer, now the oldest foreman in the employ of the Department, has been in charge of the station since 1888, giving faithful service, and managing the station with noteworthy care and economy.

Correspondence.—The station has an increasing amount of correspondence. Its success with *Atriplexes* and the primary importance of the alkali problems have given it a reputation not only in the United States, but in many other countries, so that no one of the substations receives more letters. Many of these are properly, and indeed necessarily, referred for reply to the Central Station.

Local Seed and Plant Distribution.—While the Department aims to confine its public seed and plant distribution to the Central Station, from which a yearly circular is sent out, each outlying station necessarily reaches some hundreds or thousands of farmers who are not yet otherwise in touch with the Department, and brings them into closer relations. The San Joaquin Valley substation since 1894 has grown and distributed in various ways upwards of 3,000 pounds of seed of various *Atriplexes*, and several hundred pounds of other seeds, besides many scions, grafts, cuttings, etc. This seed has been distributed in small packets, partly from the stations, partly by means of the Granges, Farmers' Clubs, Farmers' Institutes, and local newspapers of the region,

PLATE 27. VIEW OF TULARE SUBSTATION, MAIN AVENUE—SALTBUSH ALONG THE BORDER.

partly by mail (in cases where the applicant prepaid postage). The seed of *Atriplex semibaccata* is now for sale by leading seedsmen, and in accordance with the custom of the Department, free distribution from the station has ceased, but exchanges continue, and tests are being made in every new district.

Climate.—The station is situated in a region of light, and indeed often very light, rainfall. Irrigation is necessary to render the general agriculture of the district safe from disaster. But the great natural difficulties of irrigation are complicated by closely connected problems of the rise of alkali and the necessity for drainage. These three inter-related problems seem to require, for their practical solution, a greater population and more capital per acre than are at present everywhere available in the upper San Joaquin. The full conquest of so large a valley is necessarily slow, but it is hastened by recognizing, to the most complete extent, the climatic difficulties of a district as well as its climatic advantages.

Rainfall.—The average rainfall from eight years' observations at the substation has been 7.05 inches. The rainfall noted at Tulare City, at the railroad office, since 1875 has averaged 7.00 inches. The average of five years' observations at Porterville was 9.12; of twelve years' observations at Goshen was 7.97, and of seven years' observations at Hanford was 11.13 inches. Mr. Twohy reports that in 1889–90, when the rainfall at Tulare City was 11.71, it was 15.35 at Lewis Creek, east, near the edge of the Sierra foothills. The rainfall at Visalia has been kept since 1888 by Mr. Nanscawen, and he reports as follows: In 1888–9, 10.64 inches; in 1889–90, 14.22 inches; in 1890–1, 12.31 inches; in 1892–3, 10.27 inches; in 1893–4, 7.80 inches; in 1894–5, 13.41 inches; in 1895–6, 7.39 inches; in 1896–7, 11.29 inches; in 1897–8, 5.53 inches. The average of nine years' rainfall at Visalia is 10.31 inches. Visalia is nearer the Sierras, in the midst of still extensive, though rapidly diminishing, oak groves. In 1889–90, when the rainfall at Tulare City was 11.71, it was 14.22 at Visalia and 15.35 at Lewis Creek, which latter amount represented approximately the Porterville rainfall of that season.

Tulare substation receives less rain therefore than points less than twenty miles distant, such as Visalia, Porterville, and even Hanford. Bakersfield averages considerably less rainfall than the Tulare observation station. The following table shows the rainfall for the past eight years at Tulare substation:

RAINFALL (IN INCHES) FOR EIGHT YEARS AT TULARE SUBSTATION—1892–1900.

Months.	1892–3.	1893–4.	1894–5.	1895–6.	1896–7.	1897–8.	1898–9.	'99–1900.
September	.00	.00	.00	.00	.00	.59	3.75	.00
October	.26	.00	.18	.43	.74	.59	.01	1.35
November	.39	.05	.02	.98	1.11	.26	.16	1.32
December	1.51	1.07	2.44	.36	.59	.79	.19	1.28
January	.64	1.24	3.25	1.78	2.43	.63	.92	1.02
February	1.20	.38	1.23	.01	1.61	.97	.14	.10
March	3.02	.77	.86	.72	1.73	.72	2.28	.77
April	.33	.09	.60	.14	.00	.00	.17	1.73
May	.00	.26	.60	.14	.00	.59	.02	2.03
Total	7.35	3.86	9.18	4.56	8.21	5.14	7.64	9.60

The lack of February rains for the past two seasons has been the cause of light crops. It may also be observed that all the water which fell in September, October, and May was either too late or too early, and, therefore, of small agricultural service. There was really very little to choose between 1893–4 and 1897–8; both were extremely trying, and only the most careful cultivation kept the orchard from serious loss. The large grain crops obtained in the San Joaquin Valley, over an extensive area, in such seasons as 1894–5 and 1896–7, show the high value of about 9 inches of rain when so distributed as to be of the most service.

Temperature.—The usual maximum temperature at the station is from 110° (Fahr.) to 112° several times in June, July, August, and sometimes in September. The minimum of these months has never been less than 40° Fahr. The maximum temperature of March, April, and May is above 90°, and the minimum from 24° to 32°. From November to February the maxima range from 70° to 84°, and the minima from 18° to 26°. In May, 1895, 110° was reached, and in June of that year, 118°; both of which illustrate greater extremes than the season under consideration. In August, 1894, the maximum rose to 118°, in September to 108°, in October to 98°, and in November to 94°.

Frosts.—While the lowest temperature on record at the station is 17°, and the lowest in the immediate neighborhood is 16°, a temperature of 20° to 22° is not uncommon. Killing frosts occur every winter, but their number varies considerably, as shown by the following table:

NUMBER OF SEVERE FROSTS.

Months.	1894.	1895.	1896.	1897.	1898.	1899.
November	1	8	1	7	12	0
December	3	14	1	19	18	1
January	10	2	11	4	14	1
February	6	0	8	1	0	3
March	4	4	3	3	6	1
April	0	5	3	0	0	0

This table takes no account of "light frosts" of less intensity than 32°, but such frosts frequently occur in October and April. There often seems to be a close correspondence between short rainfall and severe cold. The dry and cold Decembers of 1895 and 1897, and the dry, cold November, December, and January of 1898, were especially illustrative of this relationship.

THE ORCHARD.

The station orchard has been reduced in size, after nine years of experiment, by the discarding of unsuitable varieties. It contains many and valuable kinds, and is the only orchard on similarly strong alkali soil in the district, that bears good fruit or has healthy trees. Three or four orchards and one vineyard close by have been abandoned within the past five or six years, owing to the rise of alkali. The use of gypsum, at a cost of about $2 per acre per annum, has protected all the trees that were well and deeply rooted and of species adapted to this climate.

Apples.—Previous reports on this fruit require little modification. No more apples have been lost. The crops of 1897, 1898, and 1899 were increasingly better than those of previous years. Twenty varieties fruited well in 1899, as against five in 1896. The best apples here for quality are Shirley, which has kept until March, American Pippin, another good keeper, Rhode Island Greening, and White Astrachan. The largest fruits are those of Violet, Alexander, and Red Bietigheimer. The average circumference of fruits of these varieties has ranged from 12 to 13½ inches. The early apples are fit for use in June or July, and by October all the varieties, even winter sorts, must be gathered.

The orchard has received no irrigation, but the growth of those trees which have not yielded to alkali is very satisfactory.

Pears.—After experimenting for nine years with about seventy-five varieties of pears, on strong alkali soil, we now have forty-four varieties that bore a fair quality of fruit in 1899. The blossom and leafage periods do not differ materially from those previously reported. Only twenty-eight varieties bore in 1896.

The best early pears here are Doyenne d'Ete and Dearborn's Seedling, which usually ripen in the latter part of June. Clapp's Favorite, ripening early in August, is one of the best table pears of the month. While Doyenne and Bartlett usually ripen at about the same season. Many varieties generally ripen here in September, such as Idaho, Sheldon, Duchesse d'Angouleme, Beau Clairgeau, Seckel, Frederick Clapp. Among the best keepers are Beurré Gris d'Hiver, Kennedy, Doyenne du Comice, and Easter Beurré, which last season supplied the table until March. The following sorts are worthless here: Flemish Beauty, Onondaga, and Black Pear of Worcester.

Quinces.—This fruit does not succeed very well here on alkali soil and without irrigation. The growth is poor and the fruits are small. The common varieties and the pink-flowered Chinese have borne fruit here. Quinces require a good deal of water in this district.

Almonds.—Eight varieties are now growing in the orchard, but frosts usually destroy the crop. The time of blossoming varies but little, and neither mulching the ground nor whitewashing the trees has appreciably retarded the blossom period. Some of the almonds are in bloom from early in February until about the middle of March. The tree cannot be profitable in this district.

Apricots.—Twenty-six varieties of apricots are growing in the orchard and have made large trees. Some fruit was obtained from the older trees in 1894, and again in 1897, 1898, and 1899. The late frosts very often cause failure of the apricot crop in this location. The blooming period as a rule ranges from the middle of February to the middle of March. A frost of 24° to 26° in March is sufficient to destroy the crop. Occasionally a few scattered fruits escape, but the tree is of little or no commercial value here where the high daily temperatures of January and February so commonly forces trees into blossom.

Nectarines.—The nectarine crops for 1898 and 1899 were much better than in previous years, when frost destroyed most of the blossoms. Nine varieties are grown here. The blossom period ranges from February 28th to the end of March. Stanwick, Downton, New White, and Hardwicke have been the best in quality. The nectarine is very well adapted to this region.

Peaches.—There was a very fair crop in 1897 and 1898, and a large crop in 1899. The trees are, as a rule, healthy, and have been decidedly helped by the gypsum treatment. Blossoms begin in the peach orchard with Peen-to the first week in February, which variety has never escaped the frosts. The other peaches bloom from February 20th to March 20th, as a rule, and the period of leafage is from March 1st to April 1st.

About fifty varieties of peaches are grown here, and they are ripening over a period of more than three months—June 10th to September 26th in 1899; June 30th to October 1st in 1898. The fruit was, of course, heavily thinned and was consequently large and of high quality. The best canning clings were McKevitt's, Nichols, and Yellow Tuscany. Chinese Cling is excellent, but becomes a half-free here, and this has also been observed in Visalia. Among the best freestones are Jennie Worthen, Lovell, Elberta, Wheatland, Thissell, and Salway.

Plums and Prunes.—Blossom and leafage period of plums and prunes varies little from season to season, excepting in the case of individual trees succumbing to alkali, which show a few very early flowers and leaves. The trees have been growing somewhat better in recent years, owing to gypsum treatment, but after ten years of trials of some sixty leading varieties many of them can be discarded as unfit for this location, although thriving on heavier soil in the valley. The plum stock is a failure in alkali soil; peach stock, which goes down deeper, is much better.

The Japanese plums of all sorts are a complete failure here. *Prunus Simoni* does well on Tule River and around Visalia, but not very well in the alkali soil of the station. The *Americana* types often bear very heavily, and the trees grow well. Prunes find a congenial home in many parts of the district, on less alkaline soils. The best variety on the station orchard is Robe de Sergent. The best of European table plums at the station have been Bavay's Green Gage, Belle de Septembre, Columbia, Fellenberg, St. Lawrence, Tragedy, and Quackenboss.

Figs.—Continued experiments at this station with all obtainable new varieties have shown nothing hardier than Dorée Narbus, and none of better quality for table use in this district than Du Roi. Among the best commercial sorts are Ronde, Violette Hâtive, Hirtu du Japon, Brown Ischia, and White Bourjassotte.

Date Palms.—Four more of the palms have blossomed since the last report was issued, and three prove to be staminate, or male plants. The foreman's data for 1898 are as follows:

Variety.		Date of Blossoming.
Seevah	Pistillate	April 10th to May 20th.
Ghars	"	April 26th to May 23d.
Hazaneh	"	May 12th to June 1st.
Zeb-el-Abed	Staminate	May 30th to June 20th.
Amhat	"	April 26th to May 31st.
Male plant (unnamed)	"	June 1st to June 3d.

The other varieties have not yet bloomed. It will be noted from the above, that only Amhat could easily have fructified by the pistillate flowers, but none seem to have received any pollen.

The palms have not grown very much during the past two years, as the seasons have been dry, and irrigation is not advisable, since it

forces late summer growth, which the severe frosts destroy. The frosts were especially bad in 1897–8, when the foreman was compelled to cut off every leaf from some varieties, though the palms were protected by straw and unscathed. It is not wise to irrigate palms later than June in this district.

GRASSES, CLOVERS, AND OTHER FORAGE PLANTS.

The experience of ten years at this substation with large collections of grasses, clovers, and other forage plants shows that only a few species will thrive here. The following notes, formulated by Mr. Forrer, sum up the results of many trials:

Smooth Brome Grass (*Bromus inermis*).—This grass stands drought here very well indeed until May, provided the winter is an average one as regards rain (i. e. 7 or 8 inches). After May it requires some water. On the whole, it endures drought better than any other species of grass.

Texan Blue Grass (*Poa arachnifera*).—If started early, it stands some drought, and certainly holds better the second year.

Wheat Grass (*Agropyron glaucum*).—This roots deeply and resists some drought.

Red Fescue (*Fescuca rubra*) is another grass that endures some drought, but it grows irregularly, in clumps and is unsatisfactory.

Grama Grass (*Bouteloua* sp.) endures a good deal of drought, when established. It seems to be a valuable, perennial grass and has a good reputation elsewhere. It grows 12 to 14 inches high, is soft and slender, an excellent fodder. *Bouteloua racemosa* is probably the best of this group of grasses for California.

Australian Ray ("*Rye*") *Grass* (*Lolium perenne*) does well if sown early in the fall; then it keeps in good condition till May, in ordinary seasons. After May it needs water. It is a fairly good variety here.

Perennial Ray ("*Rye*") *Grass* has been tested in plot No. 1, alkali corner then but partly reclaimed, where it grew well and withstood severe drought. Mr. Forrer thinks this one of the very best grasses tried at the station, and some of it was still green in July. It is absolutely necessary to sow seed of this grass very early, just after the first rains, or it cannot obtain a start.

Italian Ray ("*Rye*") *Grass* (*Lolium italicum*) is more enduring than the Australian and yields more and better fodder. It is liked by cattle and horses. It stands drought better than Blue Grass. Sow in November.

Soft Meadow Grass, *Timothy*, and many other grasses will start during a wet winter, but after April 1st they need irrigation and plenty of it.

Bokhara Clover (*Melilotus alba*).—The most successful forage plant tested, as far as mere growth is concerned, is the Bokhara Clover, which has stood the severest droughts almost or quite as well as *Atriplex semibaccata* and other Australian saltbushes. Its growth in one season is usually from three to seven feet, and it endures strong alkali. If well established, in a favorable season it requires no irrigation. Its well-known bitterness and coarseness make it disliked by live-stock. The large, alfalfa-like roots which descend deeply into the ground, are dis-

liked much by sheep. Range cattle probably get used to the taste of this drought-resisting clover. Bees are fond of the white blossoms. This plant is considered a nuisance in the alfalfa fields, but it can evidently be utilized in some localities.

Snail Clover (*Medicago turbinata*).—This valuable clover when sown in October or early November, according to the rains, withstands frost better than any clover tested, excepting the native bur clover; and it grows very well. It usually furnishes plenty of green feed by the first of March and often earlier. With the early sowing noted above, it seems to have value as a crop to plow-under in orchards, but unless fed down before plowing, at the station, its growth has at times been so dense that it is difficult to handle.

Clovers.—Red Clover, White Clover, Yellow Bird's-foot Clover, Horned Pod Clover, Yellow Trefoil, and most other species of clovers will grow fairly well during an average winter and continue healthy till April, when, unless constantly watered, they fail and soon perish. Sainfoin grown on sandy alkali soil is equal in quality to alfalfa, but like the clovers fails soon after the first of April.

Saltbushes.—The plantation of saltbushes remains the most important culture of the station. About twenty species have been tested, or are still being tried. Two are from Argentina, several from Africa, but most of them come from Australia. Among the new species of promise are *Atriplex pamparum*, *A. angulatum*, and *A. Kochiana*.

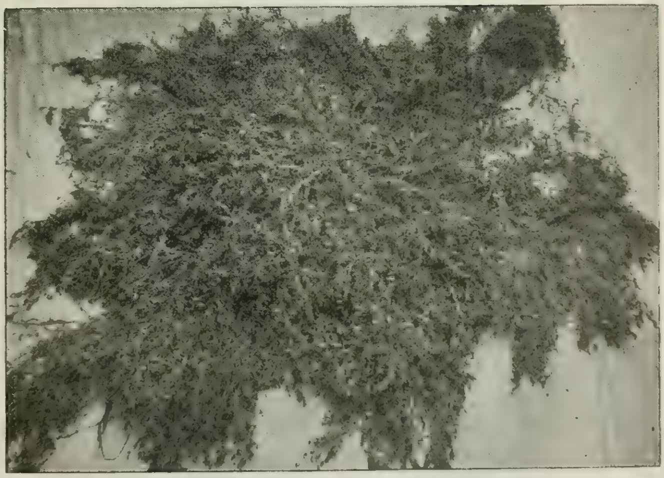


PLATE 28. ATRIPLEX SEMIBACCATA.

Spreading 6 feet in diameter.

Atriplex semibaccata (plate 28) remains the best of all the Australian saltbushes tested here. It stands drought better than other species, makes a larger growth, and produces more fodder to the acre.

PLATE 29. ATRIPLEX LEPTOCARPA.

Atriplex leptocarpa (plate 29) appears to rank next in value to *semi-baccata*, and in some localities might prove superior. Young plants often require some irrigation to give them a start in dry seasons.

PLATE 30. ATRIPLEX HALIMOIDES.

Atriplex halimoides (plate 30), at this station, grows only fifteen inches high. It is upright, stocky, coarse, and heavily loaded with seeds, more of a browsing than a fodder plant. The stem is very brittle. When cut,

it grows rapidly again, even in the hottest seasons. It is said to grow to a height of three or four feet in Australia, but does not do so in Tulare. It is less drought-resistant than the two preceding species.

Atriplex vesicaria is another shrubby saltbush of rapid growth, and larger than *halimoides*, often averaging two feet high. It is coarse, woody, and covered with seeds, but stands drought better than *halimoides*. As in the case of the latter, young plants, except in very favorable seasons, do better with some irrigation, but when established do very well without it.

Atriplex hortensis, the well-known "orache," or "mountain spinach" of Europe, is a useful annual. The seed came from Algiers, and was said to be of a very strong-growing kind used there for forage. It makes a growth of six or seven feet at Tulare in a season. Sheep are fond of the young growth, but it soon becomes too woody. This plant is an annual, and to some extent is used as a vegetable, but its value as a forage plant is very slight.

Rhagodia spinescens inermis.—This very promising species of *Rhagodia*, which is very closely related to the *Atriplexes*, does much better at Tulare than at Berkeley, as was to have been expected. It would furnish a large amount of fodder, although more shrubby in growth than any of the *Atriplexes*. It has seeded fairly well and propagates easily.

Rhagodia nutans is an extremely handsome trailing plant, which is covered with brilliant scarlet berries. This is so ornamental, as grown in this climate, that it would seem desirable for growing in pots, boxes, or garden-beds. Its forage value is yet to be determined, but Von Mueller recommends this and the preceding species; and *Rhagodia nutans* is certainly worth trial.

ALKALI RECLAMATION.

Quite the most important work being done at this substation is that of studying and experimenting with the soil. Since the issuance of the last report, the work described on pages 350–52 of that report has been continued and extended. Twenty small plots and four large ones have been worked steadily, with gypsum, and great gains have been made at an expense which is not unreasonable nor beyond the increased value of the land, although, of course, all experimental applications of gypsum at this substation must be on so small a scale that they are much more costly per acre than would be the case in extensive field practice hereafter.

Since the substation was established only about three and one quarter tons of gypsum have been applied to the acre, up to December, 1899, costing, at present prices, about $5 or $6 per ton.

One of the greatest difficulties which has attended the experiment has been the variation in the quality of the gypsum obtainable. It has been purchased from six different mines—five in California, one in Nevada. Some was badly ground and ranged as low as 60 per cent, while the best did not exceed 85 per cent. The demand for gypsum fluctuates, mines are closed down and others opened, and a uniform grade cannot easily be found. The gypsum used at various times in the reclamation work averaged 70 per cent; had it averaged 90 per cent, one fifth less gypsum would have done the work.

The gypsum was not applied evenly to the soil. Had it been so applied, the cost of gypsum per acre would have been nearer $75 than $18. It has been carefully used on all the "cores" or centers of carbonate of soda (black alkali). Careful observations of the appearance of the soil and growth of vegetation, and frequent analyses, have prevented serious waste of gypsum. In fact, the amount applied has been carefully graded at every application according to the needs of different parts of each alkali-spot. In this way, the various plots, each one of which contains one or more of these alkali-spots, have been handled separately, and thus brought to some degree of uniformity.

The amount of labor required to do all this has been very considerable, but since it has formed only a part of the regular operations of the substation, no separate account has been kept. When gypsum is applied on a large scale, the cost beyond the expense of the material will be determined by the cost of plowing, of distributing the gypsum, and of applying water. In favorable seasons, some work can be done with gypsum without irrigation by depending upon the rainfall.

During the summer, the foreman first marked off on the surface of the soil the spots showing strong alkali; then he spread gypsum on the surface and plowed it in as deeply as possible, following the plow with a second dressing in the furrows. The plots were then checked in the usual manner with the plow and flooded from two to four inches deep. When dry enough to permit plowing, it was treated a second time with gypsum, applied in exactly the same way as before.

It must be understood that this careful and thorough working of the soil of these strong "black alkali" spots appears essential to success. The whole amount of gypsum used, if applied at one time, plowed-in and left to the rains, would in large measure fail of effect, or certainly would not be used to the best advantage.

The various plots into which the station tract is divided for the purpose of reclamation differ very greatly in the character of the soil. The sandy portions need only the gypsum treatment, as outlined above; the heavier soil, which includes most of the stronger alkali land of the tract, and all the so-called alkali hardpan, is greatly benefited by receiving liberal dressings of straw, which acts mechanically when plowed-in and keeps the soil from becoming too hard. On all such plots, the foreman, after the second treatment with gypsum, spreads short straw from the field—the shorter the better, applying as much as he can plow-under. This straw decays very rapidly with the first rains, and it need not be plowed-under until then. It greatly helps the sprouting of seeds when this process of decay is sufficiently advanced. Long experience has shown that it is very difficult to get wheat to start on these plots of heavy alkali soil even after the greater part of the carbonate has been transformed, unless straw is used for a year or two, after which there is much less trouble.

It seems evident that the carbonates which have not been reached, owing to the difficulty of mixing the gypsum evenly through the soil, are usually present at some points in sufficient quantities to endanger the life of most seeds, at least in heavier soils, which are colder; seed therein germinating about two weeks later than seeds sown at the same time in sandy plots. The use of straw in the winter on these heavier soils tends to keep the surface warm and loose and to hasten germination. Late spring-sowing of seeds of any kinds on such heavy soils,

even when nearly or quite reclaimed, is unsatisfactory, even when the land can be irrigated. When irrigated, the surface soon becomes very hard, preventing germination. The best crops, therefore, for such lands, when reclaimed, seem to be those that will stand heavy frosts and can be well established early in the season, such as the hardy perennials.

Alkali soil should never be plowed when wet; nor should it be finely pulverized before the rainy season. As farmers say, "Leave it rough, and it runs together less, and does not form so hard and smooth a crust." In sowing wheat, barley, rye, or other cereals, it is better to drill the seed in than to broadcast. The drill leaves small ridges and furrows, which better carry off the water, preventing the remaining carbonates from settling in one spot, and somewhat protecting the young grain from wind and sun.

The five illustrations of alkali treatment represent work done on plots 1, 2, and 3, in the northwest corner of the tract, and on plots 4, 5, and 6, on the northern side near the new ditch, in front. These plots were originally strong "black alkali" soil, and were partially reclaimed by the use of gypsum. The rise of alkali in the tract again prevented the growth of wheat here, but further use of gypsum has now transformed so much of the surface carbonates that excellent wheat was grown in 1898 on all these plots. The season was so dry, however, that it was not possible to obtain a crop over the entire tract, as much of the seed sown failed to germinate. In fact, as was to be expected, it at first sprouted without irrigation only on the strongest alkali spots, where it grew poorly; and it only grew and throve where water could be pumped upon it.

Plate 31 shows the transformation of one of the worst pieces of black alkali, on the northern side of the tract, by the use of gypsum, as herein described, and Plate 32 shows wheat grown there. Plate 31, it must be understood, shows the "white alkali" into which the carbonates have been changed by the sulfuric acid of the gypsum. No useful crop would previously grow on such soil as that of this plot before gypsum was applied. Plate 33 is a continuation of Plate 31 to the right. Plate 34 shows similarly the change produced in another part (Plot No. 6) of the tract by using gypsum. It was formerly a projection or tongue of heavy black alkali extending southwest from the adjoining lands. It is now partly cut off by a ditch and sump along the fence. Plate 35 illustrates the character of the wheat grown in 1898 upon several of the reclaimed plots. All the heads were excellent and well filled. Plot No. 6 (Plate 34) received very little irrigation, or the wheat would have been as large as that shown on Plate 32.

Charts have been prepared for the next year's report, showing the entire history of this tract, with reference to alkali, and its gradual reclamation, plot by plot; but lack of space prevents the full discussion which should accompany their use, and, therefore, this more detailed paper will be published later.

PLATE 31. White Alkali Crust. Small Cultures.

PLATE 32. Wheat in Alkali Land After Reclamation.

PLATE 33. WHITE ALKALI WITH GOOD WHEAT.
(This plot joins No. 31 on the right.)

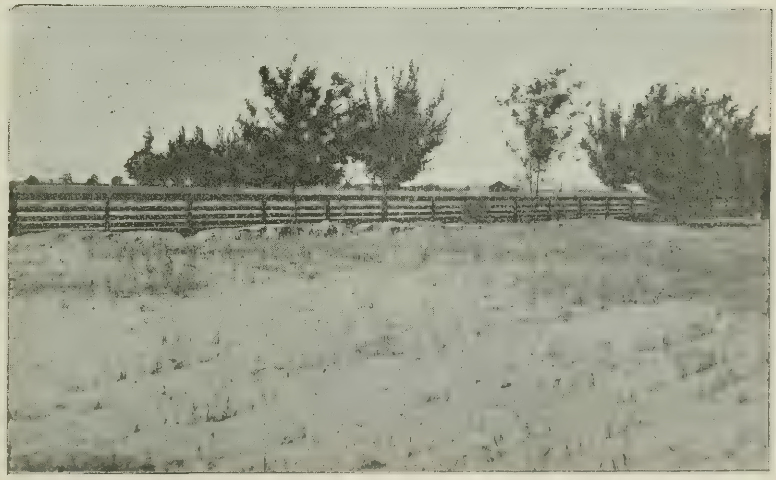


PLATE 34. PLOT 6, RECLAIMED ALKALI, WITH POOR WHEAT; PROJECTION OF HEAVY BLACK ALKALI.

Plot 1. Plot 2. Plot 3. Plot 6.

PLATE 35. WHEAT GROWN ON RECLAIMED ALKALI PLOTS IN 1898.

D. SOUTHERN CALIFORNIA CULTURE SUBSTATION.

(In Chino Valley, equidistant from Pomona, Chino, and Ontario. Elevation of home tract, 856 feet; of ten-acre tract, 800 feet.)

Since the last report was issued, improvements in this station have been continuous. A well has been bored and a windmill put up to supply water for domestic uses. On the ten-acre tract, drain tile has been laid across the upper side of the field to cut off outside water.

Support from the District.—Since the station was established, it has been increasingly popular and successful, attracting visitors from a widening area. Meetings of Farmers' Institutes and Clubs have been frequently held at the station, and delegates from meetings elsewhere have often visited it. The number of visitors increases every year.

Foreman, and Patron.—The foreman, Mr. J. W. Mills, formerly a student in the Agricultural Department at Berkeley, has now spent several years at this station, going there in 1893. During these years changes have occurred, from various causes, at all except one of the other substations. Rev. C. F. Loop, of Pomona, served as patron from July, 1896, to March, 1900, when his illness, and death, deprived the Department of his invaluable services.

Climatic Conditions.—The climate of the Chino Valley, while adapted to the successful culture of a very great number of species of trees and plants, is subject to occasional frosts, wind storms, and very hot periods. The daily range, however, is much less than at either Tulare or Paso Robles substations, and in respect to possibilities of vegetable growth, it surpasses any other farm station of the Department: everything, without exception, grown at the other stations can be grown here, and much more besides.

The following report upon the general weather conditions has been furnished by the foreman:

Commencing June 9, 1896, and lasting for twelve days, the thermometer ranged from 90° to 110°; commencing July 7th and lasting fourteen days, 90° to 101°; there were in all nineteen days in July when the range was as above. In August there were twenty-two days when the thermometer ranged from 90° to 97° during the warmest part of the day. The average daily variation for the entire season was 3° higher than for any like period since the establishment of the station. Notwithstanding the fact that there had been but 8.78 inches of rain during the preceding winter, there were excellent crops of all kinds. All sorts of fruit trees made a good growth. During the season of 1895–6, there were 23 inches of rain, which left considerable moisture in the soil when the following rainy season set in.

During the winter of 1896–7 there were no severe frosts, citrus fruits and tender plants being almost free from damage. There were 17.8 inches of rain, distributed evenly from November to April. Crops of all kinds made a luxuriant growth, and the growing season was one of

the best in the history of the station, equaling that following the winter of 1893–4.

The summer of 1897 was not excessively warm, there being but few days when the thermometer reached 100°.

The winter of 1897–8 opened auspiciously, abundant rains coming in October. But after that rain came in light showers, followed by desiccating winds from the north, so that the ground was robbed of the little moisture that fell. Winter irrigation was resorted to in many places, for the fruit trees; hay and beet crops were much below the average, even failing totally in some places. Twice during January the temperature fell to 26°, once remaining there for an hour, and once fluctuating between 26° and 27° for two hours. This did some damage to citrus fruits, but did not in any case injure the trees. The rainfall for the season was 9.39 inches, nearly $2\frac{1}{4}$ inches of which fell in May after a dry April. This did the crops little good, so the season was practically one of a 7-inch rainfall.

During the month of August, 1898, the thermometer ranged during the warmest part of the day from 91° to 108° for twenty-four consecutive days. For eight continuous days it ranged from 101° to 108°; for two succeeding days it reached 96° and 98°, and for the next four days it stood from 100° to 104°. The daily variation averaged 9° greater for July, August, and September than it had for the same periods since the station was established. This protracted warm weather following two dry winters caused a great deal of fruit to be undersized and poorly matured. Late varieties of plums were sunburned, and late peaches were tough except where water was plentiful. Pears suffered to some extent, and apples were badly injured, the bark in many cases showing signs of sunburn.

The winter of 1898–9 was again dry, and in many respects a repetition of the previous one. During the season, winter irrigation was widely practiced. Only 6.44 inches of rain fell, and at no time was the soil wet more than fifteen inches deep. Dry north winds dissipated this in a few days, and by the time the next rain fell there was practically no moisture in the soil. Hay crops were a failure, except on naturally moist land. On the 6th of February, 1899, the thermometer fell to 22°, and considerable damage was done to citrus fruits. Lemon trees were in some districts killed back to the large limbs. Extremely warm days during the winter months seemed to have hastened the opening of buds on most varieties of peach and plum trees. The effect was very marked on the European varieties of plums and prunes.

In the five preceding years the record shows very little fog, and no days entirely foggy. The climate is, in this respect, notable. The prevailing winds are the regular sea breezes, but there is occasionally a cold and strong east wind from the Mojave Desert that does injury to fruits. Since the station was established in 1890, the most severe storm of this kind was that of December 28, 1895, when 673 pounds of oranges were blown from the station trees, and the 785 pounds left on the trees were rendered unfit for use. Belts of eucalpyts and conifers would greatly protect the valley from these occasional desert winds.

RAINFALL IN CHINO VALLEY.

Year.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Totals.
1893-4	.25	1.55	1.18	4.32	1.44	1.11	.79	.13	.36	11.13
1894-5	.44	.04	.00	8.18	8.73	1.39	3.56	.66	.00	23.00
1895-6	.00	.08	1.08	.66	2.42	.00	4.39	.15	.00	8.78
1896-7	.00	.00	1.19	1.57	5.54	6.16	3.34	.00	.00	16.99
1897-8	.22	1.26	.51	.96	2.13	.81	1.22	.06	2.22	9.39
1898-9	.00	.09	.08	.51	2.79	.04	2.10	.10	.00	5.71
Average	.15+	.50+	.67+	2.70	3.84+	1.58+	2.56+	.18+	.43	10.83+

Irrigation.—The foreman, Mr. Mills, furnishes the following report upon the use of water during the dry spring of 1898:

"The orchard was plowed in blocks, each block having a tree in the center. These squares were filled with water, beginning at the lower end and working up to the upper end; then another tier of blocks was taken and the operation was repeated. This soaked the ground thoroughly over the entire space, excepting where the fall was too great. As soon as the ground was dry enough to work, it was deeply plowed and harrowed. A moderate crop of vegetation was plowed-under. After time enough had elapsed to allow this to decay, the ground was plowed again and evened up. After this the orchard was cultivated four times and harrowed twice, and appeared to be in as good condition as in years of usual rainfall. Borings to the depth of six feet, late in June, failed to show any diminution in moisture. When pressed firmly in the hand, it would form a clod.

"Following are the amounts of water used on the principal classes of fruit trees and plants between February 12th and June 15th, 1898:

Walnuts	40,000 gallons	Cherries	75,000 gallons
Peaches	585,000 "	Plums	430,000 "
Pears	410,000 "	Apples	210,000 "
Olives	340,000 "	Oranges	125,000 "
Forest trees	30,000 "	Alfalfa, etc.	285,000 "
Figs	220,000 "	Grapes	130,000 "
Total			2,880,000 gallons.

"The pears received nearly twice as much water as the apples, because green-manuring plants were growing among them for the propagation of seeds, and consequently required more. The figs required an unusual amount, owing to the fact that they were not cultivated the year before (in order to reduce, if possible, the amount of 'fig sour'), and the gophers had honeycombed the ground in places where grass had been allowed to grow. In the winter of 1898 the orchard was again irrigated by the furrow system, which proved more economical, and has therefore been used in subsequent applications of water."

THE ORCHARD.

The orchard at the Southern California substation has demonstrated many important facts in regard to fruit culture in this region, particularly in relation to the climatic limitations preventing success in certain lines, such as late-keeping apples, pears, cherries, certain kinds of peaches, plums, and prunes, and many varieties of figs. The destruction of fruit-buds by birds is still very considerable. It is, of course, impracticable to cover a whole orchard with netting; and shooting and poisoning, though reducing the evil, have not entirely removed it. The

foreman writes: "We used strychnine and water, as heretofore, but with better effect, owing to increasing the strength of the solution. We found that one ounce of strychnine to three gallons of water did swift execution. During the winter we picked up and counted 2,287 birds that had fallen near the poisoned water."

Addition to Collections.—Few trees were purchased during the winters of 1896–7 and 1897–8, since it has become difficult to find anything in ordinary nursery collections that is not now or has not been at the station. Scions or buds were received from many sources and put into trees or nursery stock. Some promising new varieties are being grown in advance of issuance by the originators. The station nursery contains many valuable new varieties which will soon be ready for the orchard.

Pome Fruits.

Apples.—Previous reports have described the apple orchard and noted the limitations of the district respecting late-keeping varieties. Summing up four years' experience with apples, Mr. Mills wrote at the end of June, 1898: "The climate of the Chino Valley does not seem to suit the apple. The trees grow well for a few years, but finally become diseased. During the last two years they have especially suffered, almost without exception, from a blight that attacks the small twigs and in some cases also the larger branches. At the junction of the small twigs with the larger limbs will be found small cavities filled with fermented sap. This seems to be eventually absorbed by the surrounding tissue, and the disease extends to other twigs. Another fungoid disease is confined to the bark and gives it the appearance of having been honeycombed by some minute worm. This disease attacks White Winter Pearmain when the trees are about two years old and continues to grow worse as the trees grow older. When it finally attacks the cambium layer, the vitality of the tree begins to decrease."

Apples cannot be considered a safe crop here when planted in commercial quantities. For a home orchard, there is perhaps no better summer apple than Red Astrachan. Stump is also an excellent variety that comes in with Alexander, is smaller, and has very white meat. The fruit is strung on the main branches on the inside of the trees. The tree is an upright grower and very prolific. White Winter Pearmain and Missouri Pippin are the best winter-apples at this station.

Several varieties that showed no sign of blight in 1897–8 had a great deal in 1898, but Belle de Boskoop and Stump were absolutely free from blight. The former is of the Russian type, and is therefore supposed to withstand sudden climatic changes, but Arabskoe, a Russian variety, is one of the worst diseased specimens in the orchard. Belle de Boskoop has not yet proved itself a desirable variety. It is making a very rank growth and is a magnificent tree, but has not yet borne fruit. Even if it bears no fruit till it is nine or ten years old, but then remains free from blight, it will be more desirable than any other early variety yet tested.

Mr. Mills gives the following lists of undesirable apples: Blighted very badly—Alexander (Russian), Nero, Smith's Cider, Skinner's Seedling, McMahon's White, Missouri Pippin, Arabskoe (Russian), and Keswick Codlin.

Blighted badly—Yellow Newtown Pippin, Twenty Ounce, Wolf River, Marshall's Seedling, Sweet Bough, and Wealthy.

Medium blight—Ortley, and Rhode Island Greening.

Dwarf and Ornamental Apples.—There is reason to think that the collection of dwarf and ornamental apples now at the station will be interesting and useful. Apples on Paradise stock and Doucin stock are popular in France and England. So far as tested in America their market value is still problematical (see Bulletin 116, Cornell Univ. Expt. St., May, 1896), but all authorities agree that they are well adapted to garden culture, giving earlier fruitfulness and often better flavor than do standards. Not all varieties of apple succeed on dwarf stock, but some varieties are especially suitable to this purpose. The literature of the subject is voluminous and very interesting to pomologists. Twenty-five apple trees, in as many varieties, all on Paradise stock, have been planted for training in trellis or cordon form. Some of these varieties are as yet wholly untried on this stock, but Alexander, Cox's Pomona, Gloria Mundi, Gravenstein, Menagere, Okera, and some others are known to be excellent. Paradise seems to be the best stock to use, but they are all grown from layers in France and vary a good deal in compactness and healthfulness. The stocks are costly and should be well chosen. They ought to be trimmed well up from the ground, and the graft inserted some distance above the collar, so as to prevent its striking root and destroying the true dwarf character.

Dwarf apples often bear the second or third year after being grafted. Red Romanite, Brownlee's Russet, and Bismarck bore at the station the first summer after being planted (fruit ripe eighteen months after the grafts were set).

The station list of ornamental apples comprises, besides Elise Rathke, the following crabs: Buechtel's Double-flowering, Coral, Currant, Malus edulis, Malus floribunda, Pyrus Parkmanni, Pyrus tenori, Pyrus spectabilis, and three or four double forms—white, rose-colored, flesh-colored—from various sources, which may prove to be only slightly distinct. Some of these are grown with great ease as pot plants, on Paradise stock, or on the same stock become such notable hedge plants as to attract universal attention in the spring. Pyrus Parkmanni, of weeping habit, is one of the best for these uses. It is also exceedingly beautiful, grafted high on an old standard tree. The fruit of none of these varieties is desirable as compared with the Siberians and such large improved crabs as the Marengo and Transcendent.

Other flowering fruit trees at the station that may be grouped with these apples are ornamental cherries, plums, peaches, almonds, and Japanese quince (*Cydonia Japonica*).

Pears.—Some varieties show more or less blight, and others, though healthy, bore no crop in 1897. The following trees were dead by the spring of 1898: Eugene Appert, which bore twenty pounds of fruit in 1896, but none in 1897; Pitmaston's Duchesse, Idaho, and Levard. One Hardy, one Lawson, and one Howell have been grafted to varieties of later introduction.

Twenty-eight varieties of pears have not blighted within recent years. The only ones, however, that bore well were Howell, Smith's Hybrid, Le Conte, Henry IV, Duchesse d'Orleans, Cole, Duchesse d'Angouleme, Epine Dumas, P. Barry, and Duchesse de Mouchy.

One of the best of these pears was Duchesse d'Angouleme. From its nativity it should be well adapted to Southern California. It proves "superior to Bartlett and a good keeper," according to the report of the foreman, Mr. Mills, who also says: "Epine Dumas was the best-flavored

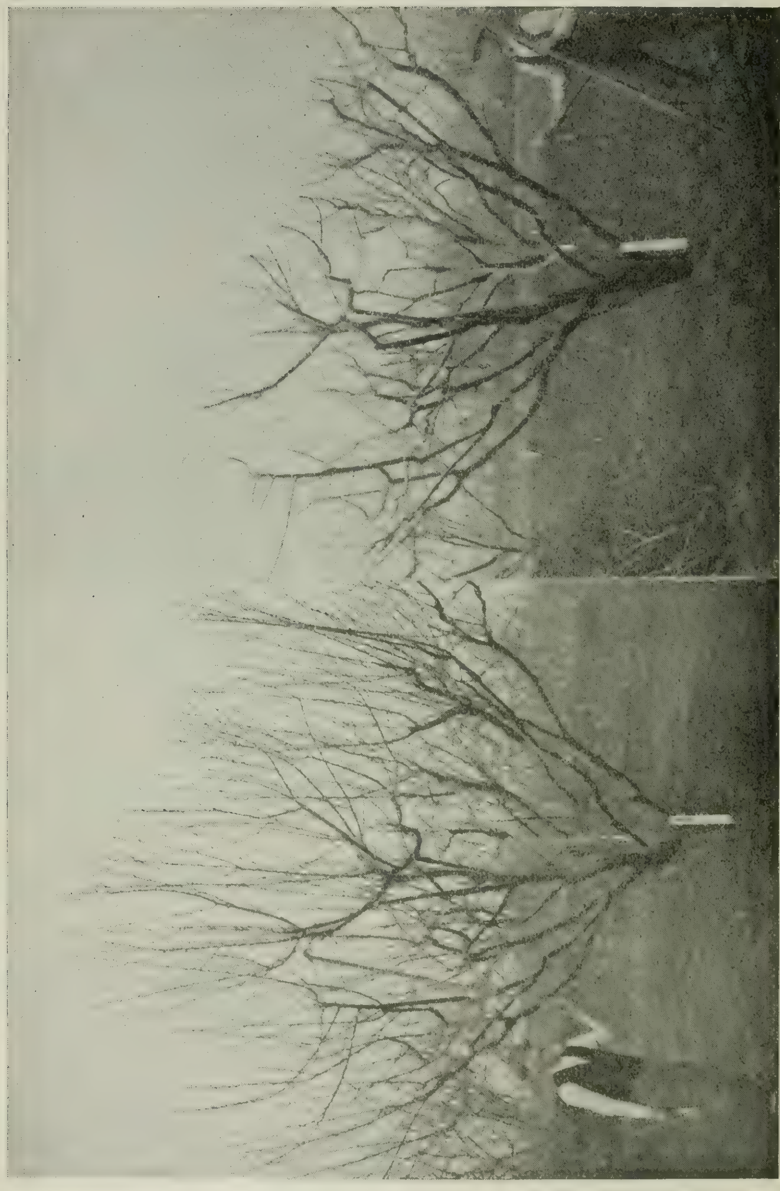


PLATE 36. PRUNING THE PEACH ORCHARD.

1 Old Mixon Cling. 2 1 Morris White. 2

PLATE 37. Effects of Spring and Winter Pruning.

pear in the orchard." Duchesse de Mouchy is a most prolific bearer, and a very late keeper.

The pears which blighted badly include thirty-three varieties and many famous sorts such as Beurré Anjou. Mr. Mills reported at the end of June, 1898, that nearly all the varieties in the orchard were then more or less affected with blight, and consequently there was very little fruit on the orchard as a whole. "The majority of the trees," he said, "have nothing on them, and none have a full crop. Bartlett has almost nothing and is badly affected with blight. This is the case with nearly all the Bartlett orchards in the valley. Epine Dumas is again free from blight and has a fair crop of fruit this season. Beurré Clairgeau is blighting, but has a fair crop. Henry IV, our best summer pear, has a fair crop, but is slightly affected with the blight. Duchesse d'Angouleme, which seemed the best of our fall pears, is this year very slightly affected by the blight."

"The blight that is so prevalent in this part of the State has taken hold of the orchards just as the gum disease did of the apricot orchards a few years ago. That now seems to have run its course, and the pear and apple blights may do the same. Root-knot is quite common among the pears of this valley, but that evidently is not what causes the blight, for trees are often killed outright by it and still have no knots on the roots."

Stone Fruits.

Almonds.—The fruit of the almond, as previous reports show, is of medium merchantable quality. The crop was poor in 1896, 1897, and 1898, but was large in 1899—six hundred and ten pounds from twenty-eight trees.

Cherries.—The value of the ordinary European varieties of cherries to the district can now be said to be settled by the experience of the station. The foreman reports: "The cherry crops of 1897, 1898, and 1899 were a dismal failure. The trees have been pruned in the same manner as are the productive orchards in the Sacramento Valley, and they were well irrigated after the rains in the spring stopped, and again when the trees were in bloom. These trees are now eight years old, and show no signs of ever setting a crop. The cherry is a universal failure. Many varieties blossom in April and May, like some of the European plums."

This may be considered conclusive, as by referring to previous reports it will be noted that all known systems of pruning, cultivating, and general management of the cherry orchard have been tried in past seasons. The only chance for fruitful cherry orchards in the valley would seem to be in heat-withstanding varieties of poorer quality, which possibly are to be found among the southeast European and north Asiatic types.

Peaches.—The illustration, plate 36, shows the system of pruning peaches, apricots, and similar fruits. The trees are headed low, kept close to the ground, and very open to air and sun. Constant renewal gives sufficient bearing wood, and keeps it healthy. Thousands of acres of commercial peach orchards in California present this appearance every winter.

Some experiments have been made at the station with regard to winter and spring pruning of the peach, and the accompanying illustration, plate 37 (from a photograph taken by Mr. Mills), shows the

effect upon the fruit of the Old Mixon Cling and the Morris White respectively.

The left hand branch, No. 1, of each is from a tree that was spring-pruned after the fruit had set, in order to save thinning. The other branch of each, No. 2, is from a tree that was winter-pruned, and thinned after the fruit had set. In each case the fruit was larger where the tree was spring-pruned after the fruit had set; and the expense of thinning was also avoided by that method.

In 1897, there were twelve varieties of clingstones and twenty varieties of freestones, besides five varieties of the early "half-cling" sorts, that bore well at the station. The season extended from June 22d to September 18th.

Peach Crop for 1898.—Mr. Mills reported as follows in the spring of 1899: "The unfavorable winter and spring preceding the summer of 1898 left the trees in a poor condition to withstand a hot, dry summer. Late varieties of peaches suffered severely where water was not plentiful. Yellow Tuscany and Sellers' Cling still stand at the head for canning varieties. These would not have matured without irrigation. Borings showed that the Yellow Tuscany tree was underlaid with cobblestones at a depth of four feet. This afforded too much sub-drainage for a dry year. The tree had not shown the effect of this sub-drainage during previous years."

Yellow St. John proved to be the best early peach for table use, following the early white varieties. Mountain Rose, Large Early York, and Cooledge Favorite continue to be favorites in their season for table fruits. Ward's Late Free is a very fine-flavored white freestone, and requires considerable irrigation to bring it to full maturity.

Baldwin Late came into bearing for the first time, and proved to be a desirable acquisition. It ripens about the 15th of November, and is sweet and well flavored. It is free from the bitterness that is generally present in very late peaches. In shape it is a little longer than broad, and the flesh is white. It is a freestone.

Fourteen varieties of clingstone and twenty-eight varieties of freestone peaches bore very well in 1898. The season of "ripe fruit" extended from June 19th to the end of October. The necessity for some irrigation has become more apparent as the trees reach maturity. The orchard has been kept in the best of cultivation, the fruit sufficiently thinned and the trees well pruned. Everything possible has been done to reduce to a minimum the amount of irrigation needed in years of short rainfall.

Test of Canning Peaches.—As the canning industry is one of the most important in the State, the foreman, Mr. Mills, had some of the leading varieties tested commercially in 1897, and reports as follows: "Six boxes of six varieties (Yellow Tuscany Cling, California Cling, McDevitt's Cling, Runyon's Orange Cling, Sellers' Cling, and Nichol's Orange Cling) were taken to the Pomona cannery and put through the process with the regular pack of other fruit supplied by local growers. The fruit was picked and assorted just as it is from a commercial orchard, and the fruit turned over to the canner. After the season's run was over, this fruit was taken out of the cans, and packed in exhibition jars by an expert manipulator.

"Taking into consideration the appearance of the fruit as to color,

absence of red at the pit, firmness of flesh, and clearness of juice, the results, as determined by the best local experts, were as follows:

"Sellers' Cling and Yellow Tuscany stood first in firmness, absence of red at the pit, and color.

"Yellow Tuscany stood first in clearness of juice, which would indicate that it was somewhat firmer of flesh; as the minute particles that on cooking are loosened from the body of the peach are what make the cloudy juice. McDevitt's Cling stood second in this respect, and the other clings were considered decidedly inferior to the above as canning peaches, not only in quality, but in firmness and appearance.

"California Cling had the greatest number of split pits; Nichol's Cling and McDevitt's Cling came next in this regard. Sellers' Cling was entirely and Yellow Tuscany was practically free from split pits.

"Yellow Tuscany was somewhat smaller than the other varieties on an average, but this was due to over-production of the trees, the two having borne 224 pounds of fruit. Two McDevitt trees bore 51 pounds, two of Nichol's Orange 156 pounds, two of Runyon's Orange 18 pounds, and two of Sellers' Cling 45 pounds. Had the Yellow Tuscany trees been thinned somewhat more, the fruit would have been fully up to the other varieties in size, and probably somewhat larger.

"The canners often recommend Sellers' Cling as the best canning peach to plant, but the records for the last two years at the station show that this variety would be very unprofitable because of its shy bearing. Yellow Tuscany always sets a fair crop, even in seasons when Sellers' is a total failure; and when the latter has a fair crop, Yellow Tuscany is very productive.

"A word of warning might well be given to those who expect to plant Yellow Tuscany on the recommendation given above. Tuscan Cling, Tuscan, and Tuskena are synonymous names for a yellow clingstone that is widely planted and propagated, and is an altogether different peach. Yellow Tuscany is a peach that originated in the Italian province of Tuscany and was imported to this country by an Italian in Alameda County in recent years. It is a very large, yellow cling that ripens during the first part of September. It makes first-class canned goods, that will stand up in shipping, and still does not make a tough article. Tuscan, or Tuskena, originated in Georgia, and was introduced into this State by Mr. Joseph Phillips in the early seventies. It was first planted in the New England orchard, on the Feather River, in Yuba County. Canners say that it is hard to sell in the Eastern market when placed beside other varieties of orange clings that are in good shape. It is known to the trade as 'rubber goods,' because it is so tough. It ripens from three weeks to a month earlier than Yellow Tuscany.

"The Lemon Cling makes the best canned pale-yellow cling, but there is such a large percentage of small fruit, even after the severest thinning, that it is not desirable. Lovell is the most promising of the yellow freestones as a canner or drier."

Plums and Prunes.—The prune crop was extremely poor in the entire district for the three years previous to 1899. The Japan plums did better as a rule. "The European plums, and especially the prunes," as the foreman reports, "make a hard struggle to leaf-out in the spring when they should make a steady and healthy growth. On some varieties a tuft of leaves will often come out here and there at odd times

from the first week in April till late in summer. The blooming period is also extended over much more than the normal time. Only a portion of the blooms, under these conditions mature fruit. It seems probable that the cause is due to the sudden extreme changes in temperature about the time the buds commence to swell. The warm, growing weather that often comes during February and March is often followed by killing frosts later in the spring. This appears to interfere seriously with the normal leafing out and blooming of prunes and plums."

Mr. Mills, from observations made upon *Prunus subcordata*, the wild plum of the Sierras, as grown at Marysville, notes that while this species in its mountain home leafs out before it blooms, it soon loses the habit in the valley, and like most of the domesticated varieties and species of stone fruits, reverses the order. It would be much better for the almond, however, if it could permanently adopt the mountain habit of *Prunus subcordata*.

It seems necessary to admit that this district is not a plum locality. Unless some of the newer plantings of Japanese and American plums succeed, plums will have to be discarded in this region, although in limited districts in Southern California plums and prunes are of unsurpassed excellence. The Wickson has proved to be one of the very best plums grown at the station.

Semitropic Fruits.

The Fig.—While many varieties of fig are a disappointment here, the experience of several years shows that the following are valuable and worth planting in similar regions: Angelique, Gros Gris Bifere, Bourjassotte Gris, Negro largo, and a good white fig of medium size imported by the Department of Agriculture a number of years ago and sent to the station under the varied names of Trojano, White Dattato, Black Dattato, and Brogiotto.

After four years' observation, the following varieties, very useful in the San Joaquin Valley, can be discarded, as so subject to "fig-sour" that the fruit is usually worthless: Hirtu du Japon, Agen, Du Roi, Ronde Violette Hâtive, and California Smyrna.

The Olive.—Excellent results have been reached with the olive at this station, and the orchard continues to develop from year to year. Mr. Mills' very intelligent report for the season of 1897–8 is as follows: "The olives began to bloom about the middle of May, and on an average they were in full bloom within a week from the time of the first opening of the flowers. Stray blossoms continued to open until late in July, but none of those produced fruit. The large pickling varieties attracted a great deal of attention in this section, and growers took all the cuttings and prunings that were available. This was especially true of Sevillano and Ascolano.

"Hill & Co., of Los Angeles, pickled a small lot of the Sevillano olives, treating them the same as Missions. The process did not answer and the fruit was lost, large blisters being produced on the olives. Private individuals experimented with some, and had fair success. These varieties are evidently too large to pickle if allowed to color up before picking.

"Experiments with self-pollenized olives were carried on, but with different results than heretofore. The blossoms that were tied in paper bags failed to produce any fruit except in one or two cases with medium-

sized olives. Former experiments had tended to show that the larger or higher-bred varieties had the power of self-pollenization, while the smaller olives did not. On a larger scale, in an orchard northwest of the station, the value of mixing varieties was apparent. An orchard of ten acres of Nevadillo olives has a few Redding Picholine trees scattered through it, and nearly all of the fruit that has been produced in the orchard came from the trees near to the Redding Picholine trees. All the trees in the orchard were very full of bloom, and the majority of the Nevadillo trees did not have enough fruit on them to pay for the picking. This orchard is so situated that the wind never blows from it toward the station orchard. Both orchards are on soil of the same character and have received the same treatment. The Nevadillo trees in the station orchard bore a fair crop of fruit. They were surrounded with free-blooming varieties.

"Following is a table showing dates of blooming and ripening, and pounds of fruit from each tree:

Olive Statistics for 1897–8.

Variety.	First Bloom.	Full Bloom.	Ripe.	Weight of Crop in Pounds.
Rubra	May 8	May 14	November 1	30
Columbella	May 10	May 15	November 10	70
Columbella (2d tree)	May 10	May 15	November 10	70
Oblonga	May 10	May 15	October 15	20
Razzo	May 10	May 15	No fruit	----
Praecox	May 10	May 15	October 25	10
Mission	May 11	May 15	October 25	45
Manzanillo	May 11	May 16	October 25	30
Polymorpha	May 12	May 16	October 25	18
Macrocarpa	May 11	May 18	October 15	25
Macrocarpa (2d tree)	May 11	May 18	October 15	25
Lucques	May 12	May 18	October 20	10
Lucques (2d tree)	May 12	May 18	October 20	14
Nevadillo Blanco	May 10	May 20	October 20	6
Nevadillo Blanco (2d tree)	May 10	May 20	October 20	7
Obliza	May 10	May 20	October 10	8
Atroviolacea	May 11	May 20	October 15	2
Atroviolacea (2d tree)	May 11	May 20	October 15	2
Oriolo	May 13	May 20	November 20	4
Pendulina	May 12	May 21	October 28	28
Ascolano	May 14	May 21	November 10	2
Attica	May 12	May 20	November 1	5
Attica (2d tree)	May 12	May 20	November 1	2
Bella di Spanna	May 14	May 21	October 20	10
Bella di Spanna (2d tree)	May 14	May 21	October 20	10
Frantojo	May 14	May 21	October 10	2
Frantojo (2d tree)	May 14	May 21	October 10	2
Nigerina	May 13	May 21	No fruit	----
Empeltre	May 14	May 21	No fruit	----
Regalis	May 15	May 21		Few pints.
Sevillano	May 15	May 22	November 15	4
Morinello	May 15	May 23	October 20	10
Cayon	May 15	May 23	November 1	3
Cayon (2d tree)	May 15	May 23	November 1	3
Santa Caterina	May 16	May 23	October 20	10
Santa Caterina (2d tree)	May 16	May 23	October 20	10
Salonica	May 11	May 25	October 25	2
Salonica (2d tree)	May 11	May 25	October 25	2
Correggiolo	May 14	May 28	No fruit	----
Cucca	May 15	May 28	November 5	2
Belmont	May 20	May 28	November 1	10
Leccino	May 20	May 28	October 10	2
Polymorpha	May 18	May 28	No fruit	----
Piangente	May 20	May 29	October 15	6
Redding Picholine	May 21	May 30	October 25	4
Rossellino	May 21	Few flowers	No fruit	----

The olives bloomed earlier and longer in the season of 1899 than in previous years, beginning eighteen days sooner than in 1898 and continuing about six days later. As tabulated by the foreman, Mr. Mills, Razzo, Rubra, and Infrantoio had the shortest bloom-season of the forty-four varieties, flowering for about fourteen days, while Oblonga was in bloom from April 20th to May 28th.

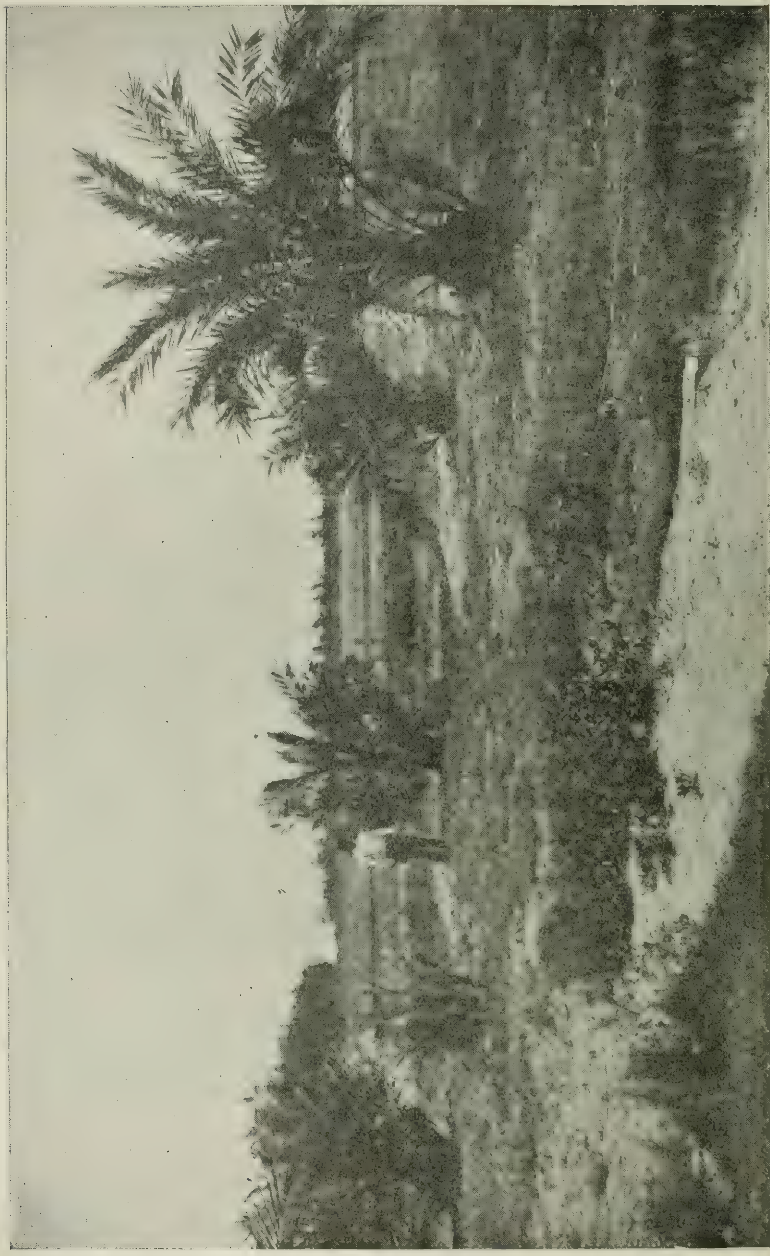
Oranges and Lemons.—The orange crop for 1896–7 was small, ranging from twelve dozen down to less than one dozen per tree. The crop of 1897–8 was very large and of fine quality. At the end of June, 1898, Hart's Tardive was not yet picked and King was still green. Malta Blood, on June 18th, was about ready for analysis. Forty-six trees (in ten varieties) yielded 5,001 pounds of oranges. The age of the trees varied from five years to nine years. The oldest (Magnum Bonums) yielded 271 pounds per tree. In previous reports of the station will be found analyses of oranges grown at this substation and at other places in California.

The orange crop of 1898–9 was a most excellent one, fifty-eight trees yielding 20,911 pounds of fruit. A noteworthy little tree was a variety known in Japan as Kino Kumi, grafted on *Citrus trifoliata* and planted out from a six-inch pot in 1895. This tree bore 168 oranges. This was an imported tree brought from Japan by Berger & Co. It seems to be an excellent variety for the semitropic garden.

Many photographs have been taken of orange and lemon trees in blossom, at the station, but they are difficult to reproduce.

Date Palms.—On June 15, 1898, Mr. Mills reported as follows: "All the date palms, except Sultaneh and the male plant, made a good growth this spring, and were uninjured by the frost during the past winter. The adaptability of the palm, as a fruit-producer in this section, depends largely on the time of ripening. If dates can be matured before the middle of December, they will be safe from frost, as a rule. In all probability, however, the season is too short. Palms are later in blooming in this region than they are in the hot sections east of here, in the desert, and there the warm season also continues till later in the winter, thus lengthening at both ends the season in which the date may mature. They have shown no signs of blooming as yet (June 15, 1898). The plants were irrigated as often as seemed necessary to keep the ground in moist condition. The male date appears to increase very slowly in size, though it receives sufficient water."

The accompanying photograph (plate 38) taken April 15, 1898, shows several of these palms. Beginning at the left hand, the first palm is Amhat; the second, a very small one, is the male; the third is Hazaneh; the fourth is Rasheedeh; and the fifth is Seewah (the variety that makes strongest growth at Tulare substation).



Amhat. Male. Hazaneh. Rasheedeh. Seewah.

PLATE 38. SOME OF THE DATE PALMS; SOUTHERN CALIFORNIA SUBSTATION.

The following table gives the statistics of this collection of African palms:

DATE PALMS AT SOUTHERN CALIFORNIA SUBSTATION, IN 1898.

Variety.	Height.	Circumference at Base.	Spread of Leaves.	Number of Suckers.
	Feet.	Feet.	Feet.	
Seewah	12	7	15	4
Zeb-el-abed	11	7	17	7
Amhat	10	5	11	6
Rasheedeh	9	4	9	2
Hazaneh	8	4	11	3
Nakleh-el-pasha	7	3	9	6
Sultaneh	4	2	7	6

FOREST TREES.

The station has grown a large number of forest trees, testing their adaptation to the region and distributing them at the proper season to public institutions and associations. During the planting season of 1898–9 trees were furnished to public parks and improvement societies in Los Angeles, Pomona, Chino, Riverside, Marysville, Pinole, Santa Ana, Sacramento, Oakland, and many other California towns. They have been planted as far north as Siskiyou and as far south as San Diego.

THE VINEYARD.

Many observations upon the vineyards at the substations and the quality of their products appear in previous reports of the Viticultural Department. The vineyard at the Southern California substation covers 4.3 acres, and the vines are planted eight feet apart. This should give 3,040 vines, but there are sixty-five vacant spaces among some of the newer varieties.

The planting of the vineyard was begun in the spring of 1891. A few varieties have been discarded and grafted over. At the present time (June, 1899) there are 235 varieties, classified as follows:

European wine grapes	117
European table grapes	37
European raisin and table grapes	8
American grapes	47
Persian and Turkestan grapes	20
Varieties for stocks	6

The foreman reports that the best bearers for the season of 1898 among the European wine grapes were Aramon, Burger, Carignane, Corbeau, Croetto, Green Hungarian, Grenaché, Kadarka, Mataro, Malvasia di Rovasenda, Pedro Jimenes, Petit Bouschet, and Syrian. An illustration is given of an average vine of Petit Bouschet, pruned long (plate 39). The photograph was taken in October, 1898.

In recent years the best European table grapes at this station have been the Bowood Muscat, Black Malvasia, Black Morocco, Cinsaut, Cipro Nero, Emperor, Flame Tokay, Gros Colman, Napoleon, Trivoti, and Verdal.

The soil of the vineyard is the poorest on the home tract, being a light sand. It received no irrigation until the spring of 1898, when 130,000

gallons of water was applied with beneficial results. In the spring of 1899 the vineyard received 640,000 gallons. Some vineyards in this district on similar soil, formerly yielding well, have been practically

PLATE 39. PETIT BOUSCHET (pruned long).

abandoned for the lack of moisture; one irrigation in seasons of light rainfall is recommended wherever possible.

The vineyard has seldom been injured by frost. One of the worst

cases occurred May 20, 1896, when eighteen varieties newly planted that year, chiefly Americans, were frozen so that they did not start again. The crop of European grapes was practically destroyed that season.

SMALL FRUITS.

The small-fruit department attracted much attention in 1896 and 1897, but the shortness of water since 1898 has compelled the abandonment of further small-fruit trials. The station has tested 110 varieties of strawberries, the most important small fruit in the district, besides the principal varieties of raspberries, blackberries, currants, and gooseberries, and local reports were made by the foreman. Palmer's Seedling was the best raspberry; California Evergreen was the best all-around family blackberry. The Loganberry throve exceedingly, and has been widely distributed from this station, as well as the more promising new strawberries and other small fruits.

SMALL CULTURES.

Cotton.—In the spring of 1897, a large collection of varieties of cotton was obtained from Atlanta, Georgia. The seed was planted in hills four feet apart each way, after the late frosts were over. When the plants were about four inches high, they were thinned to one plant to a hill. The field was hoed once and irrigated and cultivated twice during the summer. No bolls formed after the middle of September; occasional cool nights seemed to blight the blossoms after that date. The plants attained an average height of about three and a half feet. The first crop was picked October 27th, and from then on, every month, till the latter part of December. Had not the early frosts injured the plants, another good picking could have been made.

Truitt's Big Boll and Jones' Improved were late in maturing, and a great many green bolls were on the plants when they were dug up in the winter. Especially was this the case with Truitt's Big Boll.

As the table shows, Doughty's Extra Long has the longest staple, but it is very thin on the seed. Bancroft's Herlong is the next in length of staple, but is much denser and ranks second in fineness. Bates' Early has the finest fiber, none of the other varieties tested approaching it in quality. The relative fineness was determined with a high-power microscope, the tests being made several times. Jones' Improved, Bancroft's Herlong, Truitt's Big Boll, Peterkin, and Doughty's Extra Long stood second, and George Walker and Tyler's Imperial Cluster stood third in fineness of staple.

Cotton evidently is not yet a paying crop in Southern California, where land and labor are so high-priced. The crop requires good soil that is light and easy to work, and on most land it requires some irrigation. The heavy black land that raises good beet and alfalfa crops will not raise a crop of cotton that is worth picking. Cotton requires warm nights and a steady growth to give desirable results, and the low, damp lands are too cold to secure these conditions, hence irrigation and upland soils are necessary.

The following table shows relative productiveness, length of staple, denseness of fiber on the seed, and percentage of seed in the crop before ginning:

Variety.	Lbs per Acre.	Length of Staple.	Fiber on Seed.	Per Cent of Seed.	Fineness of Texture.
Bates' Early	613	1 in.	Thin	60	1st.
Jones' Improved	578	¾ "	Dense	60	2d.
Bancroft's Herlong	627	1⅜ "	Medium	70	2d.
Truitt's Big Boll	306	⅞ "	Dense	60	2d.
Peterkin	612	1 "	Dense	70	2d.
Doughty's Extra Long	571	1⅝ "	Thin	70	2d.
George Walker	621	⅞ "	Medium	60	3d.
Tyier's Imperial Cluster	533	1 "	Medium	75	3d.

The above very interesting notes on the cotton tests are furnished by Mr. Mills. The station has tested all the leading varieties from time to time in the past five years, and the conclusion reached is that other districts, such as the upper San Joaquin, are better adapted than is the Chino Valley to the growth of this useful staple.

PLATE 40. SOYA BEANS. (NO IRRIGATION.)

Soya Beans.—One fifth of an acre was drilled in between the trees of the young plum orchard. The land had been irrigated by the block system, and was in excellent condition. The beans were cultivated with a beet-cultivator until the vines shaded the ground and were too high to pass under the frame of the implement without injury.

The beans came into bloom during August, 1898, when the thermometer ranged from 90° to 108° Fahr. for twenty-one days. During this time the beans set, and 65 pounds of seed was harvested in the fall from the one fifth of an acre, or at the rate of 325 pounds per acre. About 10 per cent of the vines were killed by gophers before they

matured. The plants attained a height of three and a half feet. They received no irrigation after being planted. (Plate 40.) Soya beans can be recommended as a valuable plant for stock feed, when a concentrated food is needed to mix with other fodder.

PLATE 41. THE CAÑAIGRE FIELD.

Cañaigre.—The plantation (plate 41) of cañaigre (*Rumex hymenosepalus*) contains just one and one half acres, and was planted in February, 1895. The soil is a very light sandy loam, with considerable gravel. During seasons of abundant rainfall, the plants have made a good growth, and tubers of from five to eight inches long have been formed. During the last two seasons the plants have not made sufficient growth to mature seeds. It seems to be definitely determined that on the kind of soil described above, where it is now (May, 1899) seventy feet to water, this crop should receive irrigation to secure a profitable yield.

THE TEN-ACRE TRACT.

This tract has a naturally moist, alluvial land, with some alkali. See reports for 1894–5, 1895–6, and 1896–7.

Experiments on the various test-plots of the ten-acre tract continue, and the results show steady gains under cultivation and drainage.

Saltbushes.—Atriplex halimoides planted here did poorly and has been discarded. It prefers a drier soil. *A. leptocarpa* and *A. semibaccata* have been successful, but *A. semibaccata* does best, and on the strongest alkali.

Grasses.—Milicum multiflorum seems to do very poorly the first year from seed, but the second year it made a thick and strong growth, becoming fully three feet high.

Schrader's brome grass grows but poorly here. It does better on the sandy upland, if given water. None of the many grasses do as well as oats or barley for an annual hay crop, but Mr. Mills reports that Schrader's brome promises well as a volunteer plant in pastures.

Tests on Separate Plots.—Plot 5 contains .288 per cent of total alkali, divided as follows: sulfates, .164; chlorid of sodium, .058; nitrates, .066 per cent. On this plot, common flax and German chamomile grew but poorly. Roman chamomile and common endive failed to germinate, on account of the alkali. New Siberian millet, African millet (*Elusine coracana*), common sunflowers, and parsnips and carrots were first-class in all respects.

Plot 7, now tested for three years, contains .317 per cent of total alkali, divided into sulfates, .223; carbonates, .035; chlorid of sodium, .023; nitrates, .036 per cent. At first, Russian sunflowers and sugar beets were the only plants out of many tested here that really throve. Egyptian corn and the sorghums failed. In 1898, African millet and salsify throve, also the common field carrot. Parsnips grew fairly well, though not as well as on Plot 5.

Plot 8 contains less alkali than Plot 5 (0.233), but has .084 of carbonates, which are not shown on the latter. *Anthemis nobilis* (common chamomile) germinated, but died in thirty days. On Plots 5 and 7 it failed to germinate. The field carrots and parsnips were only fair. Jerusalem artichokes did well.

Corn was tested on several plots, and its sensitiveness to carbonate of soda was very evident. Pumpkins and squashes were even more sensitive to the carbonate of soda, and failed to make any crop.

Tests of a great variety of crops were made upon upwards of twenty different plots in 1897, 1898, and 1899, showing minor differences from year to year, but bringing out the adaptability of certain plants to the soil. A number of grasses grew from self-sown seed and came up with the first rains of 1896–7 and again in 1897–8. Among the most successful of these were awnless brome, Schrader's brome, *Holcus lanatus*, *Lolium perenne*, *Lolium temulentum*, and Japanese wheat-grass. Some of these volunteer plants grew three feet high the following summer. Mr. Mills reports:

"Some of the grasses made a fair upright growth, but did not thicken up, while others made as tall a growth and stooled out much more.

Many-flowered millet-grass makes a very thick, rank growth the second year. Schrader's brome grass does not make nearly the growth on the damp land as it does on the home tract, where, along the water ditch, it made a dense mat of fine feed before it headed out. As an annual grass crop, on semi-arid lands, I think that Schrader's brome will be a good acquisition, and will subdue, to a certain extent, the troublesome grass that goes under the name of 'Wild Rye' in the Sacramento Valley."

Kales.—Dwarf Purple, Dwarf Scotch, Tall Scotch, White Vienna, and Tall Jersey kales were planted on the ten-acre tract January 28, 1898. All the varieties made a very poor growth during the summer until fall, when Tall Scotch and Tall Jersey suddenly made a rank growth until they came into bloom. By December 15th they had attained a height of about eight feet. White Vienna grew to be five feet high. The dwarf varieties, with the exception of Dwarf Purple, succumbed to the green aphis and never bloomed. All the dwarf varieties were a failure in the dry season of 1898.

Sugar Beets.—Eight new varieties of sugar beets were tested in 1898, but the seed had arrived too late to obtain the best results. The beets did not attain a sufficient size to warrant an analysis. On April 9th four acres were planted to "G. W. I." improved seed obtained from the Chino Valley Beet Sugar Co., and one acre to Vilmorin Improved seed obtained from Berkeley. A total stand of four acres was obtained, and the sugar percentage was 15.2. Four seasons previously, in 1894, when field tests were made with leading varieties of sugar beets, the highest percentage obtained was 14.3 upon a brand known as "O. D.," imported by the Chino Valley Sugar Co. The average, however, was below 13 per cent. A considerable improvement in the sugar percentage has therefore taken place.

E. CHICO FORESTRY SUBSTATION, SACRAMENTO VALLEY.

(One mile east of Chico, and one and a half miles from the foothills of the Sierras. Elevation, 230 feet.

The Chico forestry station was originally a part of the famous Rancho Chico (26,000 acres), belonging to the late General John Bidwell. This great estate contains some of the finest oak groves known to exist in California. Portions of it still remain as wild as when the Sacramento Valley was discovered, and have been the delight of such botanists as the late Dr. C. C. Parry, the late Professor Asa Gray, and Sir Joseph Hooker.

TREE GROWTH ON RANCHO CHICO.

General Bidwell began to plant native California trees as early as 1856, and added to his arboretum many of the finer exotics, until his collection is in some important particulars one of the finest on the Pacific Coast. The most of his tree-planting was done in 1868, but it has been continued at intervals ever since. Many specimens of *Pinus sabiniana* and *Pinus ponderosa* planted in 1856 now have trunks of from 8 feet 10 inches to 11 feet in circumference, and are more than 100 feet high. Of *Sequoia gigantea* and *S. sempervirens* there are many specimens 80 and 90 feet high and girthing from 4 to 5½ feet. A native cottonwood (*Populus Fremontii*), which has grown to its present size since 1856, measures 16 feet in circumference of trunk, and is 100 feet high. Among trees planted about 1868 are the following: *Quercus robur*, 50 feet high, girth 25 inches; *Quercus cerris*, 45 feet high, girth 22 inches; *Juglans Californica*, 80 feet high, girth 13 feet; *Salisburia adiantifolia*, 40 feet high, girth 3 feet 3 inches: *Camphora officinalis*, height 70 feet, girth 6 feet 4 inches. Another camphor girths 9 feet, but is of more spreading habit. The growth of many American oaks, of pecans and hickories, of the Liriodendron, the European linden, elms, and other deciduous trees, has been surprisingly rapid. At the same time the finer spruces, firs, cryptomerias, and other conifers have done quite as well as the deciduous trees. There is as yet no complete catalogue of the native and exotic trees on Rancho Chico, but the station is accumulating data for such a publication at some future period.

Native Oak Groves.—One of the most remarkable features of Rancho Chico and the surrounding district, from a forestry standpoint, consists of very fine and large groves of second-growth white oak (*Q. lobata*). These have grown since the valley was occupied by white men and are undoubtedly the best young oak groves in California. Several of them, covering areas of from twenty to forty acres, were recently photographed for the Division of Forestry, at Washington, and the station is collecting statistics regarding the rate of growth, yield per acre, and value of the crop.

FORESTRY FINANCES AND HISTORY.

Several important changes have taken place at the Forestry Station since the date of the compilation of the last report (see volume for 1896–7, pages 406–412). Considering the very small sum now spent on

the station, it has been creditably maintained, and continues to furnish new and valuable information respecting the forestry resources of Northern California.

The State Legislature in the winter of 1896–7, fully recognizing the usefulness of the two forestry stations (one at Chico, the other at Santa Monica, both under the charge of the University of California), made an appropriation of $8,000 to carry on these stations for the two fiscal years 1897–8 and 1898–9. This amount was based upon a very careful estimate made by the Agricultural Department of the University, which itemized every proposed expenditure, and showed that with $2,000 per annum for each of the two stations, they could be greatly developed, upon extremely useful lines. The former appropriation of $5,000, or $1,250 per annum for each of the two stations, was shown to be inadequate to the full and proper growth of these important forestry stations. This item was unexpectedly vetoed by the Governor. By this veto, the Regents of the University were compelled to either seek for some legal means for abandoning these two stations, or to make the smallest possible appropriation necessary to keep them going until their permanent status could be determined. The Agricultural Department was, therefore, ordered to cut down all expenditures, and reduce the rank of the stations. The appropriation made to sustain them both was $1,500 for the fiscal year 1897–8. The appropriation for the fiscal year 1898–9 was increased to $1,630. The appropriation for 1899–1900 was $1,230.

To sum up this brief history: The two forestry stations, when receiving $2,500 per annum from the State, were, in point of proportionate development, not very far behind the four farm stations, on each of which the University spends from $2,000 to $2,200 per annum (from the United States Agricultural Experiment Station Fund). The appropriation made by the Legislature of 1896–7 would have raised the forestry stations to practically the same level as the farm stations, and so would have greatly increased their permanent efficiency.

The meager allowance for the station at Chico necessarily forced a change in the method of managing the place. It was put under a workman, instead of a foreman, and though always run economically, a multitude of new, hard-time economies were put into practice. Mr. A. B. Boland, long the active and efficient foreman here, was sent to the Sierra Foothills substation for a short time, and was thence transferred to a vacancy at the Central Station. Mr. H. B. Allen, of Chico, who had been for a year under Mr. Boland, was promoted in July, 1897, to be "workman in charge," and was left, without assistance, to carry on the station.

A floor was laid in the wagonshed, and rooms made of rough mountain lumber for Mr. Allen and his wife. They gradually improved the surroundings of the building, and made a pleasant home out of this frontier-like combination of barn, wagonshed, stable, and cottage.

In July, 1897, Mr. Pennell resigned as Patron, being about to leave Chico, and Mr. V. C. Richards, editor of the "Chico Record," was appointed. He has taken much interest in the station, visiting it often, helping and advising, so that its success under trying circumstances is largely due to his efficiency.

The Lath House.—A small lath-house, 12 feet by 40 feet, was built in the spring of 1897, and has been extremely useful, enabling seedling conifers to withstand the summer heat. It has been occupied ever since,

and among the species grown there and in lath-covered frames were upward of forty species of conifers, which were mostly removed to nursery or to plantations, in the winter of 1899. Many of these species are new to California.

CLIMATIC CONDITIONS.

As shown in the foregoing pages, the climate of this portion of the Sacramento Valley must be exceedingly favorable to the growth of a great variety of trees. The rainfall is usually abundant and the summers, though hot, are tempered by sea breezes. The most serious difficulties are caused by late and often severe frosts. Still the lists of species of trees and shrubs represented at the station and published in previous reports, show that there are gains as well as losses. Many oaks and other hardwood trees grow especially well here. The limitations of the district are more distinctly marked in the case of the eucalypts and acacias than in that of any other class of trees.

Rainfall.—The following table, chiefly compiled from observations made by A. L. Nichols, of Chico, covers fifteen successive seasons:

RAINFALL AT CHICO—SEPTEMBER, 1885, TO JUNE, 1900.

Season.	Rain Began.	Rain Ended.	Total Rainfall in Inches.
1885–6	Sept. 24, 1885	May 6, 1886	31.13
1886–7	Oct. 15, 1886	June 12, 1887	17.16
1887–8	Nov. 29, 1887	June 17, 1888	14.49
1888–9	Sept. 15, 1888	June 27, 1889	21.56
1889–90	Oct. 7, 1889	May 11, 1890	52.71
1890–1	Sept. 29, 1890	July 8, 1891	23.46
1891–2	Oct. 28, 1891	June 10, 1892	22.40
1892–3	Oct. 8, 1892	May 18, 1893	33.56
1893–4	Sept. 7, 1893	July 11, 1894	23.32
1894–5	Sept. 29, 1894	May 27, 1895	34.56
1895–6	Sept. 10, 1895	May 11, 1896	25.54
1896–7	Aug. 30, 1896	June 20, 1897	22.44
1897–8	Sept. 28, 1897	Apr. 30, 1898	12.81
1898–9	Sept. 25, 1898	Apr. 1, 1899	18.45
1899–00	Oct. 13, 1899	May 12, 1900	24.89

The average annual rainfall, on the basis of this table, is 26.06 inches. In the fifteen years the rainfall twice fell below 15 inches, and four times below 20 inches. Four times, however, it was above 30 inches.

The total rainfall of the dry season of 1897–8 was distributed as follows: September, .09; October, 3.24; November, 1.27; December, 1.98; January, .73; February, 2.69; March, .13; April, .46.

The rainfall for December, 1889, which was 12.64 inches, was more than the entire rainfall of the season of 1897–8; and the total of December and January, 1889, was 22.18 inches, which surpasses the rainfall for four of the twelve seasons herein tabulated.

Temperature.—The following temperature statistics are compiled from fifteen years' observations, ending with 1898, and made by the railroad agent at Chico and by various Weather Bureau agents:

Average winter temperature	46.9°
Average spring temperature	62.4°
Average summer temperature	81.1°
Average autumn temperature	64.1°
Average annual temperature	63.6°
Highest temperature	115.0°
Lowest temperature	18.0°

The lowest point of 18° was reached April 17, 1883, when the spring growth of many grapevines was killed. It was again reached in the spring of 1888. The minimum of 20° has been reached on many occasions. March 17, 1898, the minimum was 22°, and this destroyed a good deal of the fruit crop. Large trees of *Eucalyptus globulus*, a foot or more in diameter, were killed to the ground in 1883, and others have been injured on several occasions since. The species of eucalyptus described as hardy here have withstood 20° at the station. The extreme maximum of 115° has not yet been recorded at the station (since 1894). The summer heat, while great, is not a moist heat, and is easily endured.

Climatic Vicissitudes of the Past.—The late General John Bidwell, whose invaluable and characteristic pioneer recollections have been drawn upon by every historian of California, furnished us a very interesting synopsis of the seasons before 1852, in the Sacramento Valley. The following notes were taken from his conversation on the subject in May, 1898:

Season.	Character.	General Bidwell's Comments.
1840–1	Very dry indeed	Livestock suffered much.
1841-2	Very wet and warm	Great floods. Cattle drowned.
1842–3	A dry season	
1843–4	Another dry season	Time of Fremont's first expedition. So little snow in the Sierras that he was able to cross without much difficulty.
1844–5	Medium wet	Would have been a very good agricultural season.
1845–6	Wet, but not cold	Fremont's second expedition.
1846–7	Medium wet	Time of Mexican War.
1847–8	Dry and cold	Discovery of gold.
1848–9	Wet and snowy; a remarkable year.	Snow in December, 1848, one foot deep over valley; in January much more snow. Hard drifts three feet deep in valley, near where Chico now stands. Snow lay for a month before melting.
1849–50	Very wet	Much suffering in mining camps.
1850–1	Dry	
1851–2	Dry to very dry	Much complaint from cattlemen, even on the Coast.

Additions to Arboretum, Etc.—In the spring of 1898 many specimen trees, in some cases from ten to one hundred of a sort, were planted in the arboretum or in forest form. The additions include the following oaks: *Quercus alba, Q. bicolor, Q. cerris, Q. coccinea, Q. densiflora, Q. Douglasii, Q. dumosa, Q. ilex, Q. imbricaria, Q. macrocarpa, Q. nigra, Q. phellos, Q. robur, Q. rubra, Q. Wislizeni.*

The other additions were chiefly deciduous, and included *Aphanantha aspera*, two species of *Celtis*, three species of *Colutea*, two of *Fraxinus*, several of *Robinias* and *Gleditschias*, two species of *Rhus*, economically valuable, and a number of species from the southern Alleghanies, the trees of which region seem to thrive better here than at any other California substation. A dozen fine trees of *Arbutus Menziesii* (the Madroño) were set in the arboretum.

A large number of selected trees were shipped in the spring of 1897 to various points north of Chico, also to a number of points in the San Joaquin Valley and in Southern California, so as to afford comparative tests of species on different soils and at different elevations.

Nursery in 1898–9.—So many shipments have been made, and so many trees planted out, that the nursery stock is greatly reduced, but it contains some fine conifers such as *Cupressus Corneyana* and *C. Lusitanica*, also some broad-leaved evergreens, principally from Chile, the Southern States, and Japan; also, some new willows, many useful deciduous trees, and ten or twelve species of economic and flowering shrubs, for which a separate place has been selected near the west entrance. *Magnolia glauca* is doing very well. *Persea Lingue* and *Boldea fragrans* also seem well adapted to the place.

Self-sown Seedlings.—An interesting feature of the station is the extent to which forest trees and other seedlings are now growing in various parts of the grounds. In May, 1898, the following species were observed, in great numbers, from self-sown seed of the previous autumn: *Juglans Californica*, *Catalpa speciosa*, *Paulownia imperialis*, *Negundo Californica*, *Fraxinus Oregana*, *Cercis Texensis*, and *Vitis Californica*, besides sycamores, cottonwoods, and willows. A few *Cupressus sempervirens* and *Pinus Austriaca* have grown from self-sown seeds in the groves of these species.

STUDIES OF TREE DEVELOPMENT.

The especial fitness of the soil and climate of the region to the production of timber and to the growth of a very great number of species of trees, is shown by the following notes of measurements made at the forestry station. In each case, typical trees have been chosen for the measurement, and marked. Where wide variations occur, several trees are measured. The blocks are remarkably uniform in size of trees, and now so cover the ground that cultivation has properly ceased. Except in the case of the Araucaria, the trees represent close-planted groups:

TABLE I. STATISTICS OF LARGE CONIFERS.

Name.	No. of Trees Observed.	Measured October, 1897.		Increase Since 1894.		Soil.
		Height	Girth.	Height	Girth.	
		Feet.	Inches	Feet.	Inches.	
Araucaria Bidwelli	1	12	6½	3 5/12	2	Gravelly; hard.
Chamæcyparis Lawsoniana	35	18	22	10	10	Red loam.
Cupressus sempervirens	460	26	18	11	10	Gravelly; red.
Pinus Austriaca	75	18	16	13	10	Dark, sandy loam.
Pinus insignis	10	25	28	14	19	Red loam.
Pinus resinosa	225	22	17	15	10	Gravelly; red.
Pinus sylvestris	400	16	14	9	5	Gravelly; red.
Pseudotuga taxifolia	10	11	8	7	5	Red loam.
Sequoia gigantea	100	27	36	14	20	Dark, heavy loam.
Sequoia sempervirens	20	22	16	16	8	Light, sandy.

The age of all these trees is about the same. They were planted in 1888 or 1889, but no record was kept by the persons at the station before the forestry work was given to the State University. Cultivation

began in 1894, and by 1896 the trees were beginning to grow rapidly. Some of the *Pinus resinosa* in July, 1899, were 30 feet high, with girth of 21 inches. The ones measured give a fair average, and the grove surpasses in general appearance the other pines. *Pinus insignis* (Monterey pine) makes better single specimens.

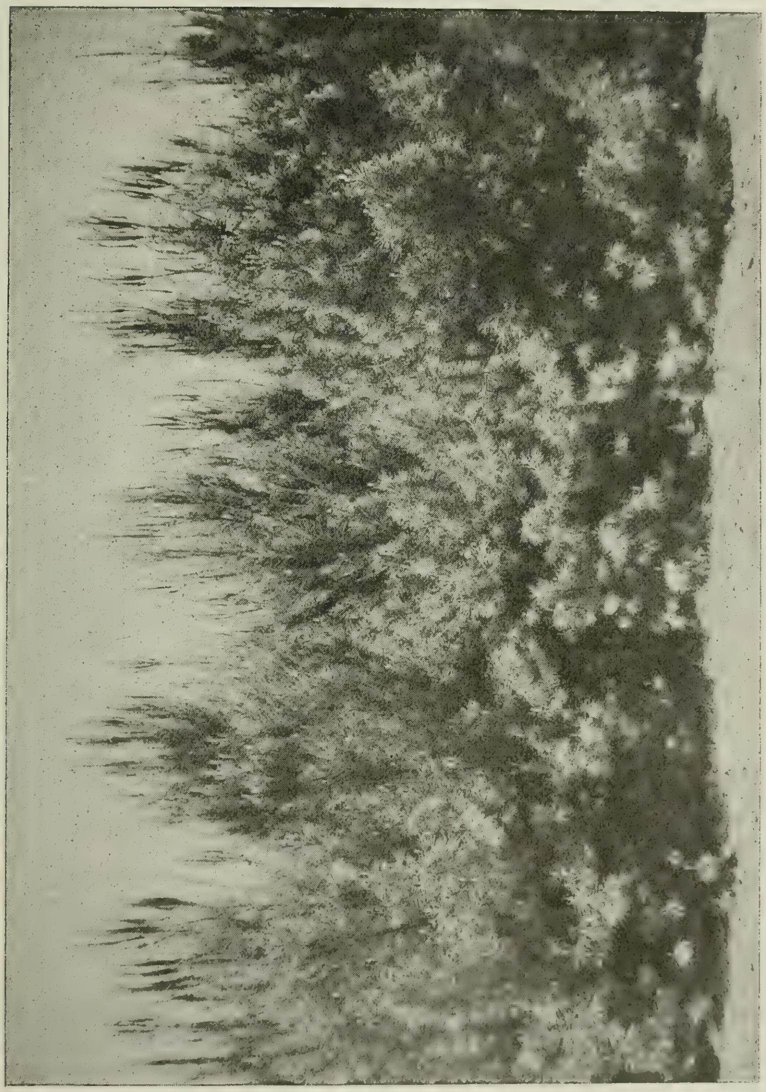


PLATE 42. A BLOCK OF PINES (*P. resinosa*), CHICO FORESTRY STATION.

The Italian cypress (*Cupressus sempervirens*) is in two closely planted groves. The best upright or columnar specimens are from 25 to 30 feet high, with a trunk circumference of 12 to 14 inches and a shaft circumference of 9 or 10 feet. The spreading specimens are usually about 20

feet high, with larger trunks. While much less attractive than the columnar specimens, they are equally valuable for timber.

The trees of a small block of *Thuya gigantea* (Port Orford cedar), not tabulated, are about fifteen feet high, with branches that cover a circle of 12 feet across, and, like those of the other conifers, are beginning to interlock. All the older conifers showed in June, 1898, a spring and early summer growth of 12 to 24 inches.

The large deciduous trees on the station are growing quite as well as the conifers. The following table shows some of the principal groups and several specimens of especial usefulness:

TABLE II. STATISTICS OF LARGE DECIDUOUS TREES.

Name.	No. Observed.	Measured Oct., 1897.		Increase Since 1894.		Notes.
		Height.	Girth.	Height.	Girth.	
		Feet.	Inches.	Feet.	Inches.	
Betula alba (European White Birch)	75	20	6	----	----	Planted in 1895.
Catalpa speciosa (Catalpa)	50	30	26	14	10	A few are much larger.
Fraxinus Americana (American Ash)	10	20	13	10	3	Some girth 16 inches
Juglans Californica (California Walnut)	54	28	27	15½	13	Some are 33 feet tall.
Negundo Californica (California Box Elder)	60	25	19	10	8	Ungainly and crooked.
Paulownia imperialis (Paulonia)	20	28	34	9	15	Some are 40 ft. high.
Populus fastigiata (Lombardy Poplar)	3	60	36	----	----	Very beautiful specimens about 10 years old.
Populus Fremontii (Cottonwood)	1	50	30	----	----	
Ulmus campestris (Huntingdon var.)	2	21	16	22	12	Planted in 1894.

The birches noted in above table were received by mail in 1894, when a few inches high, and placed in nursery. In January, 1895, they were set out in a group adjoining the block of Sequoia. Their growth has been marvelous, and justifies all that previous reports have said about the value of *Betula alba* as a street tree.

The Huntingdon elm has grown faster than the American and other species tested here, and it also is a more shapely tree.

The box elder grows rapidly, but it has little value and is less attractive than the soft maples. Where much better trees will thrive, it is a pity to plant box elder. The catalpa, with its showy flowers, is far more attractive. The paulownia has little economic value here, though its soft lumber has ornamental uses in Japan.

Considering the quality of its product, the rapid growth of the ash here is very suggestive. It thrives well on the various soils of the station. Several species of ash are being tested, all giving promise of usefulness.

TABLE III. Statistics of Recently Planted Deciduous Trees.

Species.	Where and When Planted.	Size as Planted.	Size in 1896.	Size in 1897.	Size in June, 1898.
		Feet.	Feet.	Feet.	Feet.
Acer dasycarpum (Silver Maple)	Mixed forest, Jan., 1895	3½	6	10	12
Acer campestris (European Maple)	Mixed forest, Jan., 1895	4	5	7	8
Acer platanoides (Sycamore Maple)	Arboretum, Jan., 1895	3	4	7	8
Alnus glutinosa (Elder)	Arboretum, Jan., 1894	3	8	14	16
Betula lenta (Birch)	Hardwood forest, Jan., 1896	1	1¼	1½	1⅔
Catalpa speciosa (Catalpa)	Mixed forest, Jan., 1895	3	6	8	10
Celtis occidentalis (Nettle tree)	Mixed forest, Jan., 1895	4	8	13	15
Cerasus serotina (Wild Cherry)	Arboretum, Jan., 1895	1½	4	7	8
Cladastris tinctoria (Yellow Wood)	Arboretum, 1894	5	6¼	7½	8
Diospyrus Americana (Am. Persimmon)	Arboretum, 1896	3	----	8	9½
Fraxinus Americana (White Ash)	Arboretum, 1894	2	4	6	7
Fraxinus dimorpha (Algerian Ash)	Hardwood forest, Jan., 1896	1	2	4½	6½
Fraxinus Oregana (Western Ash)	Hardwood forest, Jan., 1896	4	----	7	9
Fraxinus viridis (Green Ash)	Arboretum, 1895	4	6	9	10
Juglans Californica (California Walnut)	Mixed forest, Jan., 1895	4	5	8½	9½
Morus alba (White Mulberry)	Mixed forest, Jan., 1895	4	6½	9	11
Morus "Lhoo" (Jap.? Mulberry)	Row near ashes, Jan., 1897	4	----	8	10
Negundo Californica (Box Elder)	Mixed forest, Jan., 1895	4	6	10	12
Paulownia imperialis (Paulonia)	Mixed forest, Jan., 1895	4	10	15	18
Ptelea trifoliata (Wafer Ash)	Arboretum, 1895	3	5	6½	8
Pyrus Americana (Wild Apple)	Arboretum, 1895	1	4	7	7½
Quercus robur No. 1 (English Oak)	On avenue, 1894	2	5	8	9½
Quercus robur No. 2 (English Oak)	On avenue, 1894	2	9	14	15
Quercus robur No. 3 (English Oak)	Mixed forest, Jan., 1895	2	6	8	9
Tilia Americana (Basswood)	Arboretum, 1896	5	----	7	9

The number of trees of the above species planted varies from two or three in the arboretum to a hundred or more in forest form. All receive cultivation to keep the weeds down and the surface mellow. The catalpas and tilias planted in 1895 were in blossom in May, 1898. The white mulberries planted at the same time were bearing fruit.

The English oaks (*Q. pedunculata*) vary greatly in size and nature of growth. Some are shrubby, branching near the ground, and requiring free use of pruning knife to form a good trunk; others need no assistance. The average height of the oaks planted in 1895 in mixed forest is now 7 feet, well branched, and with trunks of 3 to 4 inches in circumference. One oak planted in 1894, when 3 feet high, is now 13 feet high, with branches covering a circle 10 feet in diameter, and a trunk circumference of 4½ inches. The spring growth of 1898 of such a tree is from 6 to 12 inches on every branch. One tree planted in 1894

bore acorns in 1897, and several are bearing in the present season (1898). Deciduous oaks are easily moved when not more than 4 feet high if well trimmed, and after a year or two of small growth make new leading roots and grow fast. The tap-roots should be cut in the nursery the year before removal.

Many species of oaks thrive in the central Sacramento Valley district, and here, perhaps sooner than in other parts of California, it would seem that the planting of oaks for timber might be profitable. The species indicated are (1) *Q. pedunculata*, *Q. suber*, *Q. cerris*, and other oaks of Europe and Asia Minor; (2) some of the East American species which have heretofore failed in many parts of California. The Japanese oaks suffer from the sun. Our native species grow rapidly, but are of inferior value for timber. In all, the station has tested or is testing some forty species of oaks, and every year is obtaining others new to the district.

Next to the oaks, the ashes promise results in the hardwood forest. The growth of our native species under cultivation is exceedingly rapid. The ash is worthy of wider dissemination. Several new species of ash were only planted out in the spring of 1898, and, therefore, need more time to develop their characteristics. *Fraxinus dimorpha*, of Algeria, proves, upon further acquaintance, to be a tree of slow growth, but of especial beauty. It is often shrubby, like some specimens of the English oak, and needs pruning to give it a start. Other specimens are beautifully pyramidal in shape, and would make attractive lawn trees. The wood seems exceedingly tough. Nine species of ash are now growing on the station grounds.

Among other hardwood trees recently planted in considerable numbers are *Celtis orientalis* and *C. Australis*, also *Zelkova keaki*. The latter forms quite a grove, as well as being represented in the arboretum. Like *Fraxinus dimorpha*, some specimens are shrubby in growth, while others grow tall and quite rapidly.

The growth of *Diospyrus Americana* (persimmon) here is much better than elsewhere in California, as far as noted. The growth of *Cerasus serotina* is less satisfactory here than at the Southern California substation.

Betula alba, forming a small grove, is listed in the table of larger deciduous trees. Smaller trees of later planting show the same adaptation to the district. The three largest birches at the station are nearly 30 feet high, with trunk circumference of 18 inches. These are in the aboretum.

The largest *Gymnocladus Canadensis* in the arboretum stands 15 feet high, with a girth of 7 inches.

Rapidity of Growth.—The following brief table compares several of the best specimens of rapidly growing deciduous trees at the Chico substation:

Species.	Planted.	Height when Planted.	Height Oct., 1897.	Girth Oct., 1897.	Height. Oct., 1899.	Girth Oct., 1899.
		Feet.	Feet.	Inches.	Feet.	Feet.
Acer dasycarpum (Silver Maple)	Jan. 1896	6	12	10	16	1⅓
Paulownia imperialis	" 1895	6	20	13	36	3½
Platanus racemosa (Nutt) (California Sycamore)	" 1896	6	22	14	38	2⅓
Salix salmoni (Asia Minor Willow)	" 1896	4	32	22	49	$2\frac{5}{12}$

THE COLLECTION OF WILLOWS.

A good deal of correspondence has resulted from the establishment of the willow grove at the station. About 4,000 cuttings were distributed to various points in California in the spring of 1898, and another distribution was made in the spring of 1899. All the plants grew from cuttings planted in 1895, and were moved to the arboretum in February, 1896. The soil is a rich, sandy loam, eminently suitable for willows. When planted the willows were cut to a uniform height of 4 feet. Three species and varieties, it will be noted, have not increased in height since being planted, but have spread out, forming bushes. In the table, the different sorts are arranged in order of present height.

STATISTICS OF WILLOW PLANTATION.

(Fifteen of the best species; from cuttings; 10 months in nursery; 21 months in grove.)

Species or Variety.	Height.	Circumference of Trunk.	Spread of Branches.	Notes.
	Feet.	Inches.	Feet.	
Salix salmoni (or S. alba salmonii)	32	22	12	Grew 12 feet in nursery; was cut to 4 feet; grew 15 feet in 1896.
Salix viminalis (a variety from Meehan)	19	16	12	Very strong grower; coarse basket willow.
Salix alba vittelina	16	12	8	
Salix regalis	12	9	6	Resembles type form of *alba*.
Salix alba (type)	12	8	5	Little difference except in amount of growth.
Salix Sieboldii	11	10	6	Light green bark; slender leaves.
Salix dasyclades	10	6	8	A very ornamental species.
Salix viminalis (golden)	10	9	10	A very fine basket willow.
Salix Madenii	10	9	8	Very large, glossy leaves; highly ornamental species.
Salix daphnoides	10	7	5	
Salix Japonica	9	8	9	Purplish bark.
Salix Britzensis	8	7	6	A showy, dark-leaved species.
Salix pentandra	8	5	4	A noble English species, with large, glossy leaves.
Salix cordata	6	5	5	Whitish and green bark; ornamental.

EUCALYPTS AND ACACIAS.

The tests of Eucalypts and Acacias at Chico substation have now been continued for several years, and supplemented by observations on trees in General Bidwell's collection and elsewhere. The district is evidently unsuited to a wide range of species in these two important classes of trees.

Eucalypts (old trees).—The Third State Forestry Report (for 1889–90) states that *Eucalyptus viminalis* was the most successful species tested; *E. obliqua* grew but poorly; *E. rostrata* did not thrive as well as *E. viminalis.* Many species were planted, possibly most of those tried at Santa Monica, but no records were kept. At the present time, large trees are on the Chico substation, of the following varieties: *viminalis, rostrata, globulus, obliqua, eugenoides.*

E. viminalis grows very fast here, and forms a noble tree, perfectly hardy, but not always able to sustain itself against the winds. Trees

PLATE 43. GROUP OF EUCALYPTUS TREES (*E. viminalis*).

80 feet in height and 12 inches in diameter, planted since 1888, are on the station grounds. Trees thirty years old are on Rancho Chico.

A very curious and interesting group of *E. viminalis* stands on the station grounds. The trees were evidently heeled-in, in a short trench, when taken from a nursery, and grew there. At the present time, from a small base 30 feet long and 3 feet wide, spring twenty-two large and some thirty small trees. The twenty-two largest are from 50 to 75 feet high, and from 12 to 35 inches in circumference of trunks. The thirty small trees have merely existed for years past. The trunks touch at the base (90 square feet), and widening in search of light and air, fill, at the height of fifty feet, a quadrilateral of about 1,000 square feet. This remarkable illustration of extremely compact tree growth on good soil is shown in the accompanying reproduction from a photograph (plate 43).

The only living specimens of *E. globulus* stand in a much sheltered position among large white oaks. They have several times suffered from frost, and large branches have been killed. Under these circumstances, the total growth of this species is considerably less than that of *E. viminalis*.

One of the most sturdy species on the station grounds is *E. eugenoides*, a fine, strong, upright tree, as hardy as *viminalis*, but of less rapid growth.

In point of attractiveness, no eucalypt at either Chico or Santa Monica surpasses *E. viminalis*, var. *minima*, a beautiful weeping tree, which adds to an upright stem the charm of long, graceful, trailing branches, as slender as those of the weeping willow; and has proved entirely hardy here. This species should become a very popular shade and ornamental eucalypt for Northern California. The small, white flowers, abundant in March and April, fairly cover the tree.

New Tests of Eucalypts.—Since 1894, seeds have been sown and plants raised of some thirty species obtained from the Melbourne Botanic Gardens, from Vilmorin, Paris, and from the Santa Monica substation. The following notes show results to date:

Eucalyptus alpina was planted in forest in the spring of 1896. The tallest tree is now 6 feet, with spread of 2½ feet. It grows much better than at Santa Monica. The growth of 1897 was 14 inches. The new growth of 1898 was 6 inches, when measured in May. Hardy here.

Eucalyptus acerbula (quite rare and new to California). Planted in 1896. Tree a beautiful one, with remarkably fine, delicate leaves and red bark. Height 2 feet in October, 1897. Spring growth of 1898, 1 foot. Hardy here.

Eucalyptus gunni. Planted in 1896. Trees of 7 feet in height badly frozen. The growth of 1897 was 4 feet. This species will probably be somewhat hardier when large, but is of doubtful value here.

Eucalytus "*Foeld Bay.*" Planted in 1896. The best tree so far tested in the forest. Largest specimen, 9 feet, with 6 feet spread of bough. In appearance it resembles the blue gum, but the young growth is very red, and more attractive. Hardy here.

Eucalyptus leucoxylon. Planted in 1896, when very small. Height, October, 1897, 3 feet. Trees healthy and hardy here. A great acquisition to the district, but a grower and chiefly ornamental.

Eucalyptus resinifera, and others. *E. resinifera* is very tender here; only one tree is left, and shows no tendency to sprout from the base. *Eucalyptus rudis* is also very tender here, and unfit for the district. One tree of 18 inches is still struggling to recover ground. *E. tereticornis* is another species that is too tender here, though of somewhat better growth. The following species have been frozen to the ground, and did not again start: *E. cosmophylla*, *E. cinerea*, *E. Lehmanii*, *E. acmenioides*, *E. andreana*, *E. botryoides*, *E. decipiens*, *E. floribunda*. Adding to this list *E. maculata* var. *citriodora*, *E. ficifolia*, and *E. calophylla*, which have proven too tender here, either in nursery or after being planted in the grove, we have fifteen species that it seems necessary to discard.

Large Acacias.—The most hardy acacias planted here some years ago are *A. melanoxylon* and *A. pycnantha*. *A. decurrens*, the black wattle, in all its varieties, while semi-hardy, and eventually making a large tree, is liable to have large branches killed back. This is particularly noticeable with *A. mollissima*, the popular street tree. *A. melanoxylon* has not suffered seriously in twenty years of trial in the Chico region. *Acacia cyanophylla* is only semi-hardy here.

F. SANTA MONICA FORESTRY SUBSTATION.

(In Santa Monica Cañon, two miles west of Santa Monica.)

The situation of the Santa Monica Forestry Substation has been described in previous reports. It is easily accessible from Los Angeles by frequent trains passing at the mouth of the cañon, and has many visitors, at all seasons of the year. Its progress, like that of the Chico substation, has been slow, by reason of the small appropriation, which has prevented many and much needed improvements. Mr. Roy Jones still serves as patron. Mr. John H. Barber, who was appointed foreman in 1896, was promoted to the Paso Robles foremanship in September of 1898. His successor at Santa Monica was Mr. Charles A. Colmore, a graduate of the Agricultural Department, University of California. Mr. Barber did excellent work at Santa Monica, and the following chapter, though edited, condensed, and brought down to date, is largely from his reports:

Water Supply.—During the past two years the inadequacy of the water system has been increasingly felt. In the winter of 1897–8 a small windmill was erected, with tower and pump, which saves the waste of the hydraulic ram, and raises more water to the middle mesa, where it is most needed.

Distribution of Seeds and Plants.—The mature trees on the station increase in number, and furnish more seed each year, and the collection of seeds for public distribution and for exchange has become an important feature of the work. By means of this annual distribution, various species of eucalypts and acacias, and other trees tested and found of value here, have been introduced throughout the State to be more widely tested under different conditions. In addition, the station is enabled to obtain by exchange rare seeds from abroad for trial here. It may be as well to repeat in this connection, that the distribution of seeds collected at this and other substations is made as a part of the regular annual seed distribution from the Central Station at Berkeley.

Station Herbarium.—Botanical specimens of a large number of the trees on the station have been prepared. A set of these forms the nucleus of an herbarium, which will be invaluable for reference in the determination of species, especially in the case of the eucalypts. As is well known, the nomenclature of the species of eucalypts introduced into the State by nurserymen and others has become much confused. Specimens of eucalypts grown in various sections are often sent to the station for identification.

A second set of these specimens has been placed in the Herbarium of the Botanical Department at Berkeley. Collections of eucalyptus specimens have also been sent, by request, to the Arnold Arboretum of Harvard University, and to the United States National Museum (Smithsonian Institution) at Washington, D. C. These will be added to as time permits. Another collection has been made for the Missouri Botanical Garden, St. Louis.

Botany of the District.—Some attention has been given to the study of the local flora, and several hundred specimens have been collected for the Herbarium of the Botanical Department at Berkeley.

In this connection acknowledgment should be made of the kindness of Professor A. J. McClatchie, of the University of Arizona, and of Dr. H. E. Hasse, Surgeon of the Soldiers' Home, near Santa Monica. The latter gentleman has placed freely at the disposal of the Forestry Station not only his botanical library, but also his invaluable knowledge of the flora of Southern California.

CLIMATE.

Rainfall.—The season of 1897–8 was exceedingly hard on tree growth. The lack of late spring rains in 1897, and the exceptional dryness of the following winter, made up a combination of circumstances peculiarly trying to vegetation. The rainfall at the station for 1897–8 was only 5.24 inches, and the full benefit of this was not received, because it came in small quantities at long intervals, and was followed by strong, drying winds. As shown by the accompanying table, there was no rain at all at Santa Monica during the months of November and December, 1897. The spring rains were very scant, and cereal crops in the district were practically a failure. Light showers at the end of April and middle of May enabled some little hay to be made, but were not sufficient to be of much benefit to trees. Every possible effort was made to keep the station plantations in good growing condition by thorough cultivation of the soil. In addition, the tops of many of the large trees were heavily thinned to reduce their draught on the soil-moisture.

The following table shows the rainfall by months, as compared with that of the previous season:

STATISTICS OF RAINFALL, IN INCHES.

	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total.
1896–7	.31	.00	.86	1.96	1.99	6.05	3.42	1.54	.00	.00	16.13
1897–8	.00	.32	1.17	.00	.00	1.37	.32	1.10	.36	.60	5.24

District Comparisons of Rainfall.—It is interesting to note that the annual rainfall at Los Angeles, twenty miles inland, though larger, differs little from that at Santa Monica; but, as might be expected, proceeding farther eastward along the base of the Sierra San Gabriel toward the loftier peaks of the San Bernardino Mountains, one finds the rainfall to increase materially. This will be seen at once in the following statement, giving the annual rainfall at Santa Monica, Los Angeles, and Pomona for five consecutive years:

COMPARATIVE RAINFALL STATEMENT, IN INCHES.

	1893–4.	1894–5.	1895–6.	1896–7.	1897–8.	Total for Five Years.	Average per Year.
Santa Monica	7.83	14.01	8.40	16.13	5.24	51.61	10.32
Los Angeles	6.73	16.11	8.51	16.86	7.06	55.27	11.05
Pomona	10.90	23.00	8.78	17.89	9.37	69.96	13.99

Temperature.—The spring of 1898 was also unusually trying in the matter of temperature. Complaints of the unusual coldness of the season were general in the neighborhood. Truck farms on the low lands south of Santa Monica suffered heavily. Even those in the so-called frostless belt of the foothills did not escape unscathed. Heliotropes, cannas, the choicer roses, and other tender garden plants, which ordinarily winter perfectly at Santa Monica, were this year cut down by the frost in many cases, and the leaves of *Eucalyptus robusta* and *E. globulus* (blue gum) were quite badly frosted in the town.

The accompanying table gives the temperature at the Forestry Station for the fiscal year ending June 30, 1898, compiled monthly from the continuous, automatic record of a thermograph kept on the middle mesa of the station tract, where the main plantations are located:

MONTHLY SUMMARY OF TEMPERATURE.

	Maximum.	Minimum.	Mean Maximum.	Mean Minimum.	Mean Temperature.
1897—July	80°	51°	73°	57°	65°
August	88	52	76	58	67
September	90	51	76	57	67
October	81	45	70	50	60
November	89	39	70	47	59
December	88	33	67	43	55
1898—January	82	31	60	41	51
February	78	40	65	44	55
March	78	35	65	43	54
April	98	40	70	49	59
May	72	45	66	49	58
June	93	48	72	55	64
For the year	98°	31°	69°	49°	60°

Effects of Frost.—It will be noticed that only once did the thermometer fall below the freezing point. In fact, this middle mesa, where the observations were made, enjoys an exceptional immunity from frosts, due evidently to its intermediate position in the cañon or barranca, midway between the higher mesa level of the surrounding plains and the lower level of the cañon bottom. Even here, however, this year the tender young growth of the scarlet passion-flower (*Tacsonia manicata*) was touched by frost. New shoots of *Phytolacca dioica* also were frosted, but no other damage was done to trees and shrubs.

On the colder creek level, where the nursery is located for convenience to water, the young shoots and in many cases the swelling buds of mulberry cuttings were killed. Japanese willows (*Salix Japonica* and *S. Sieboldii*) were slightly damaged; native and Eastern willows remained uninjured. Foliage of the rubber tree (*Ficus elastica*) was frosted. A large *Jacaranda mimosæfolia* lost two years' growth of wood; the new growth of a young umbrella tree (*Melia Azedarach*) was killed back; while a fine hedge of *Pittosporum undulatum* looked for a time as though flames had swept over it.

Comparison of Temperatures.—As with the rainfall, so in the matter of temperature a comparison has been drawn between Santa Monica,

Los Angeles, and Pomona, as shown in the following condensed table giving the main points of the temperature record at each:

	Santa Monica.	Los Angeles.	Pomona.
Maximum temperature for year	98°	99°	104°
Minimum temperature for year	31	30	26
Mean maximum temperature for year	69	73	77
Mean minimum temperature for year	49	51	46
Mean temperature for year	60	62	62

THE YOUNG EUCALYPTUS GROVE.

This plantation, set out in the spring of 1897, on the upper mesa, as noted in the last annual report (page 418), has thriven better than might have been expected, considering the character of the past season. A few trees have died from drought, but on the other hand the growth of the majority has been gratifying, and some species have done exceedingly well under difficulties.

Eucalyptus globulus, the well-known "blue gum," used in this plantation for shelter purposes, maintains its reputation for rapid growth. It may be taken as a standard in estimating roughly the relative rapidity of growth of other species, though we must always bear in mind that different species are naturally adapted to different conditions, and each species will, of course, grow best under the conditions best suited to it.

E. goniocalyx, a tall-growing species, made a growth even surpassing that of the "blue gum," the best specimen being of the same height, 14 feet, when two years old from seed, while the general average is higher. This species was especially recommended for new plantations by the late Baron F. von Mueller. The inferior growth of the single specimen in the older grove on the middle mesa has not borne out this recommendation, but these young trees so far appear to justify it.

E. rostrata and *E. tereticornis*, closely allied species, and *E. Stuartiana* follow closely with a growth of 12 feet each for the best individual tree, when two years old from seed, and an average of 7 to 8 feet; while *E. acmenioides*, *E. Andreana*, *E. angulosa*, *E. cinerea*, *E. Foeld-Bay*, *E. Muelleriana*, and *E. urnigera*, all new introductions, are not far behind.

Growth at Different Ages Compared.—As some of the species in the new plantation are also represented in the old grove on the middle mesa, some instructive comparisons can be drawn. At seven years from planting *E. rostrata* measured 45 feet in height and 10 inches in diameter of trunk, *E. tereticornis* 55 feet in height and 9 inches in diameter, while the height of *E. Stuartiana* at the same age was only 28 feet, though its trunk diameter was 9 inches, equal to that of the much taller *E. tereticornis*. These marked differences emphasize a point which must be kept in mind when considering the relative growth of young eucalyptus trees, that the *rate* of growth often varies with the age of the trees, so that trees of different species which make an equal growth during the first year or two, may, nevertheless, differ widely in size some years later.

New Eucalypts.—The new eucalypts include the following species:

E. acervula	E. cornuta	E. jugalis	E. paniculata
E. acmenioides	E. cornuta var. Lehmannii	E. maculata	E. polyanthema
E. Andreana	E. cosmophylla	E. maculata var. citriodora	E. Risdonii
E. angulosa	E. decipiens	E. megacarpa	E. resinifera
E. botryoides	E. dumosa	E. microcorys	E. rostrata
E. calophylla	E. Foeld-Bay	E. Muelleriana	E. Stuartiana
E. cinerea	E. goniocalyx	E. obcordata	E. tereticornis
E. coccifera			E. urnigera

Of many of the above-named species little is known, except from meager foreign repots; but the information at hand, viewed in conjunction with their growth so far, indicates that some of them will be of notable value for this State. *E. coccifera* and *E. urnigera* are reported as especially hardy. The latter is also rated by Baron von Mueller as the most antiseptic of all the eucalypts, and therefore of especial value for planting in malarial districts. The wood of *E. botryoides*, *E. microcorys*, *E. Muelleriana*, and *E. paniculata* is said to be very durable underground, and thus excellently adapted for fence posts, railroad ties, etc.

Experiments on a Large Scale Needed.—Tests on a small scale are apt to be misleading, on account of the difficulty of eliminating merely accidental factors. Therefore, it is probable that the average rate of growth of individual species, as well as the relative rate of growth of different species, under certain conditions in California, could only be determined with exactness by the continued observation for a series of years of several hundred trees of each of the species under trial, planted in solid blocks. Experiments on this scale, however desirable, the station has not at present the means of undertaking. A large area of more uniform soil would be necessary for such experiments.

RECENT ADDITIONS TO THE ARBORETUM.

New species of trees and shrubs are continually being added to the permanent collections on the station. Many of these are raised from seed or cuttings in the station nursery; others are obtained from outside sources.

Pseudotsuga taxifolia, the Douglas spruce, proved a failure on the middle mesa. It needs more moisture, and will be tried again on the creek level.

OTHER TREES AND SHRUBS.

Acacia Koa is a beautiful and rare species from the Sandwich Islands.

Casuarina glauca, from Australia, there called the Desert Sheoak, grows rapidly and endures considerable drought. All the casuarinas are valuable trees for dry localities and barren places. They grow rapidly and furnish excellent firewood. Young trees of *C. glauca* grown from seed on the station in 1896 and planted out in the spring of 1897, when about one foot in height, grew in one year to a height of 5 to 7 feet, and in 1899 were 12 feet high.

Cytisus scoparius and *Genista juncea*, natives of Europe, are showy, free-blooming shrubs, well suited to dry situations. The former furnishes a yellow dye, can be used for tanning, and has been highly recommended for arresting the drifting of loose sands.

Ligustrum Japonicum, the Japanese privet, is a useful hedge plant.

Myoporum laetum, from New Zealand, is an excellent shade tree. It makes a fairly rapid growth, bears exposure well and withstands drought. It grows well on this station and also at Berkeley.

Schinus terebinthifolius, a new "pepper tree" introduced from Brazil, shows great promise. A near relative of the common pepper tree, *Schinus molle*, it is rated a much more desirable tree. In habit it is more upright and symmetrical than *Schinus molle*, and its foliage is heavier, with shorter, broader, thicker leaflets of a rich dark green color, glossy and shining. A number of seedling trees were planted at the station in 1897 on a well-drained gravelly slope. At time of planting they were about one foot high. No rain fell after they were set out, but they received a bucket of water each several times during the summer. A year from planting, the best ones measured 6 feet in height, while the average was about 4 feet of stout growth. At first the young trees branched freely, from the ground up, and they expended considerable energy in this way before the tendency was finally checked by pruning and pinching back the shoots. These trees bore some seeds in 1899, and will soon yield sufficient for distribution.

Cedrela odorata, a native of Central America and the West Indies, furnishes a valuable wood much used for cigar-boxes.

Cercidiphyllum Japonicum is an important timber tree of Japan, and ranks high also as an ornamental.

Eriodendron anfractuosum, the Kappa, or Silk Cotton tree of the West Indies, has failed to grow here. It seems to require a moister climate.

Phytolacca dioica, or *Pircunia dioica*, the Ombu of the South American pampas, is a quick-growing shade tree with heavy, deep green foliage, suitable for sidewalks and roadsides. The new shoots are liable to be killed by spring frosts, but the tree seems fairly hardy, and is worthy of extended trial. At this station in two years from the seed it has attained 7 feet in height, with a girth of 11 inches at one foot from the ground.

EFFECT OF DROUGHT ON TREES.

The shortness of the rainfall of 1897–8 and 1898–9 necessitated extra precautions against the loss of rare trees by drought. Besides keeping down weeds and conserving the moisture in the soil to the utmost extent by frequent and thorough stirrings of the surface with the cultivator, it was deemed advisable also to take measures, as far as means permitted, to lessen the demand of the larger trees on the soil-moisture. To this end, all limbs which could reasonably be spared were removed from many of the large eucalypts, thus reducing the area of their foliage and consequently decreasing materially the amount of water transpired by them. The effect of this thinning of the crowns of the trees has so far been satisfactory.

Drought Resistance of Eucalypts.—In the main eucalyptus grove during 1898 no trees succumbed to drought, though several showed signs of distress. On the whole, the results here were conclusive, except as regards the inferior drought-resistance of *E. obliqua*, which is confirmed by other observations.

The smaller grove at the north end of the middle mesa, on the west side of the main road, contains trees of *Eucalyptus calophylla*, *E. cornuta*, *E. corynocalyx*, *E. globulus*, *E. leucoxylon* (smooth-bark form), *E. rostrata*, and *E. viminalis*. Of these a single *E. globulus*, a spindling tree, died from drought; the balance of the grove is in perfect health.

East of the road, on the sloping ground at the base of the steep bluff rising to the upper mesa, the grove consists of *E. cornuta*, *E. corynocalyx*, *E. globulus*, *E. leucoxylon*, *E. obliqua*, *E. paniculata*, *E. rostrata*,

and *E. viminalis*. Here, of *E. obliqua* four out of twelve trees died from drought, a loss of 33 per cent. Of *E. viminalis*, ten out of twenty-three perished, a loss of about 43 per cent. *E. viminalis* suffered, also, on the heavier soil of the upper mesa. Its losses here amount to about 25 per cent. No other large trees failed on this level. Evidently, judging from observations during several seasons on different soils and levels, this species is deficient in drought-resisting qualities. This is to be regretted, as its rapidity of growth and moderate toleration of alkali make it otherwise a desirable tree for windbreaks and firewood on the alkaline plains. Trees of *E. polyanthema* on the upper mesa, planted along the edge of the steep bluff, stopped growing, but held out well and pulled through.

Miscellaneous Trees.—Of the acacias, several small specimens of *Acacia melanoxylon* died, but the older trees stood the drought well. The same was true of *A. decurrens* and *A. mollisima*. *A. pycnantha* showed more resistance to drought than the other two principal tan-bark wattles; no trees of this species died, and only one or two showed signs of distress. A few camphors (*Cinnamomum camphora*) have succumbed on the middle mesa. All other trees withstood the drought of 1897–8 excellently.

EUCALYPTS IN CULTIVATION IN 1899.

The following list shows the species of eucalypts represented by trees in the station plantations July 1, 1899. It does not include plants still in the nursery:

EUCALYPTS IN CULTIVATION AT SANTA MONICA, IN 1899.

E. acmenioides	E. diversicolor	E. megacarpa	E. Risdonii
E. alpina	E. dumosa	E. melliodora	E. robusta
E. amygdalina	E. eugenioides	E. microcorys	E. rostrata
E. amygdalina var. angustifolia	E. ficifolia	E. Muelleriana	E. rudis
E. amygdalina var. regnans	E. globulus	E. obliqua	E. saligna
E. botryoides	E. gomphocephala	E. occidentalis	E. siderophloia
E. buprestium	E. goniocalyx	E. occidentalis var. macrandra	E. sideroxylon var. pallens
E. calophylla	E. Gunnii	E. paniculata	E. sideroxylon var. rosea
E. coccifera	E. Gunnii var. undulata	E. Planchoniana	E. Stuartiana
E. coriacea	E. hæmastoma	E. platypus	E. tereticornis
E. cornuta	E. Lehmanni	E. piperita	E. tereticornis var. latifolia
E. corymbosa	E. leptophleba	E. polyanthema	E. tetraptera
E. corynocalyx	E. leucoxylon	E. pulverulenta var. cinerea	E. urnigera
E. cosmophylla	E. macrorrhyncha	E. punctata	E. viminalis
E. crebra	E. maculata	E. resinifera	
E. decipiens	E. maculata var. citriodora		

DESCRIPTIVE NOTES ON A FEW SPECIES.

Eucalyptus corynocalyx, the sugar gum, is well enough known to render detailed description of the tree unnecessary here. It grows rapidly, and when given plenty of room usually branches freely and forms an immense, spreading, leafy crown. It blooms profusely in summer, and is very attractive to bees. Its habit of seeding freely often causes the heavy masses of seed-pods to overweight the branches so that they break easily in a high wind. It may be reckoned, nevertheless, a useful tree for roadside planting, and, also, singly or in groups, for diversifying the landscape on treeless plains. It affords plenty of shade, and its spreading habit and dark, glossy foliage render it a conspicuous and pleasing object in the landscape. The wood is useful and said to be very durable in the ground.

Eucalyptus cornuta, the "Yate" of Southwest Australia, is another eucalypt of spreading habit. The foliage is somewhat thin, however, and does not afford a heavy shade. The leaves are small, narrow, dull green in color, but shining with a metallic lustre in sunlight. The flower buds resemble close clusters of small horns, whence the specific name *cornuta* (horned). These horn-like calyxes fall away, leaving the blossoms in globular, pompon-like heads of yellow filaments. Later the filaments also fall, and the fruit develops in close, spiny clusters. The wood of *E. cornuta* is hard, tough, and elastic, and is highly esteemed in Australia, being there considered equal to ash. (Plate 44.)

PLATE 44. BRANCH OF E. CORNUTA VAR. LEHMANNI.

PLATE 45. BRANCH OF EUCALYPTUS CALOPHYLLA.

Eucalyptus calophylla is one of the handsomest species of the genus. It makes a straight, symmetrical, sturdy, leafy tree, with cinnamon-colored bark, and oval, pointed, bright green leaves. The large, creamy white flowers are borne in heavy clusters during August, September, and October. The fruits are large and remarkable. They are rudely goblet-shaped, some two inches or more in length and an inch in diameter. These pods or capsules make excellent pipe bowls, and can be utilized also for umbrella handles and the like. The tree endures some frost, makes a fairly rapid growth, and may be ranked as a fine ornamental and a useful shade tree. Its wood is hard, close-grained, and finely veined. The illustration (plate 45) shows a cluster of leaves, flowers, and

PLATE 46. BRANCH OF EUCALYPTUS FICIFOLIA.

fruits, as photographed at the station.

Eucalyptus ficifolia, the scarlet-flowered eucalyptus, is closely related to *E. calophylla*, but is even a handsomer tree in habit and foliage, not to mention its magnificent blossoms. It makes a symmetrical, pyramidal tree, as shown in plate 46. The leaves are large, oval, and pointed, thick in texture and dark green in color, paler beneath. The flowers, as in *E. calophylla*, are borne in heavy trusses on the ends of the branches, in August and September. They are brilliant red in color, varying on different trees from scarlet to crimson, always very showy. They are followed by heavy and pendent clusters of large pods, almost as large as those of *E. calophylla*, which are well shown in the illustration. The bark is cinnamon-colored and persistent. *E. ficifolia* is of much slower growth than many of the eucalypts, and never attains a large size, the maximum height being about fifty feet, but as a showy ornamental of striking beauty and a handsome avenue tree is not surpassed.

PLATE 47. BRANCH OF EUCALYPTUS OBCORDATA.

Eucalyptus obcordata is a curious small tree of some ornamental value. Its dull, red flowers are borne more or less the whole year round. The leaves are small, thick, and of a dull green

color. The broad, flattened, recurved flower stalks are well shown in the illustration (plate 47).

Eucalyptus maculata var. *citriodora*, the lemon-scented gum, is a rather slender, straight-stemmed tree, with long, slender, drooping branchlets, and long, narrow, sickle-shaped, bright green leaves. It is a summer-bloomer, bearing its cream-colored flowers in good quantity, principally in June and July. The bark is very striking—smooth and beautifully colored in pale gray and lavender tints, and the leaves are exquisitely lemon-scented. The habit of the tree is graceful. Here it shows a marked tendency to branch out on the windward side, toward the sea breeze, like the apricot. It will stand some frost, being hardy at Oakland, Cal. It furnishes a useful timber, and deserves a place in any collection of ornamental trees.

PLATE 48. EUCALYPTUS ROSTRATA, OR "RED GUM."
A very hardy and valuable timber tree.

Eucalyptus rostrata, the red gum, has been very generally confused in this State with *E. viminalis*, a much inferior tree. *E. rostrata* is a fast-growing tree of erect habit, with persistent, smooth, gray bark, and drooping foliage of a grayish-green color. The blossoms are creamy white, small and in small clusters, produced freely in early summer. The tree endures extreme heat, resists frost better than many eucalypts, and stands considerable drought without suffering. Its timber is hard, strong, and durable. It has been alleged that the blossoms of this

species are fatal to bees. Such is certainly not the case at this station. Here the bees seek them eagerly, but repeated careful observations have failed to discover a single dead bee in the neighborhood of the trees. Few trees can be better recommended for general planting than this the true "red gum." It is one of the species that should be much more freely grown in California. The illustration (plate 48) shows the small seed-pods and drooping stems so characteristic of *E. rostrata*.

Eucalyptus corymbosa is a handsome, symmetrical tree of pyramidal habit. Its leaves are narrowly oval, slightly sickle-shaped, a rich dark-green in color, paler beneath, with a conspicuous white midrib. The new leaves are light-yellowish green, with dark-green veining, very attractive. The creamy-white flowers are borne profusely in large, showy, rather loose clusters on the ends of the branches, giving the tree a most ornate appearance when in bloom. The bark is reddish brown, smooth and finely fissured, persistent. As an ornamental tree *E. corymbosa* ranks with the best of the eucalypts. Its blossoming season has extended here from August through into December, affording good bee forage. Its timber is said to be very hard and very durable for underground purposes, but inferior for use in the arts on account of the amount of kino or gum it contains, whence the popular name of "Bloodwood." It should, however, make good fuel.

ACACIAS AND OTHER TREES.

Acacia cyanophylla, blue-leaved acacia, is a low-growing, spreading tree, branching near the ground, its radiating branches and long, drooping branchlets forming a perfect leafy canopy. Its leaves, or more properly phyllodes, are long and narrow and of a bluish cast. The globular flower-heads, borne profusely along the branchlets and twigs, are larger than those of many acacias, and are of a rich orange color. When in bloom, in spring, the tree is very showy. It is admirably adapted for parks and lawns, where it can have room to display its beauties. It is also a useful tree for the home yard.

Acacia melanoxylon, the blackwood acacia, is a neat, straight-stemmed, symmetrical tree, of regular, pyramidal outline. Foliage very dense, dull green. Flowers pale yellow, in the usual small globular heads. A desirable tree for sidewalk and roadside planting where compact growth and formal effect are desired. The timber is highly valued for many purposes. It is hard, finely grained, and takes a good polish. Even in the young state it makes excellent firewood, about equal to live oak.

Casuarina stricta. An erect, branching tree, with the typical slim, jointed, horsetail-ash-like branchlets in lieu of foliage. In this species the branchlets are short and rigid, resembling pine needles, and are arranged in tufts. The bark is smooth, dark brown. This is a unique tree for avenue planting, and for producing certain ornamental effects in grouping.

Angophora lanceolata. The Angophoras belong to the same order as the eucalypts and are very similar trees, differing only in minor botanical characteristics. *A. lanceolata* yields a strong, heavy timber. It has dark green, sickle-shaped leaves, and large white flowers produced in heavy trusses on the ends of the branches in summer, when the top of the tree is one immense cluster of blossoms. The bark is smooth, bronze-colored, and deciduous.

Fraxinus velutina, the common ash-tree of the arid Southwest, has proved here a valuable tree for dry localities in California. It grows rapidly, and in a few years makes a beautiful umbrageous tree, on dry soil without irrigation. It leafs out early in the spring, and holds its foliage until quite late in the autumn. It can be recommended as a valuable deciduous shade tree for hot and dry localities, but while doing well on dry soils, it will amply repay irrigation. Seedlings of this species obtained by Mr. R. E. Houghton from this station in 1893, when only a few inches tall, and planted by him on his Kern County ranch, in 1896 measured 20 feet in height and 12 feet in spread of branches. These received some irrigation. Seedlings of the same age planted on the station, and not irrigated, attained in the same time 14 to 15 feet in height and 10 to 14 feet spread of limbs. The best of the latter now measures about 17 feet in height and the same in spread.

Quercus robur, var. *pedunculata*, the pedunculated English oak, with typical foliage and fruit. This tree furnishes most of the oak timber used in Great Britain; from it were built the "wooden walls" which antedated the modern ironclad, and it still plays an important part in shipbuilding as well as in other industries. Though naturally at home on heavy, moist soils, this oak has grown well here on light, gravelly soil without irrigation, and seems well adapted to our drier climate. Its rapidity of growth as compared with our native oaks is remarkable, and it is undoubtedly a tree which should be largely planted, where the object sought is a supply of most excellent timber in a comparatively short period of time.

The Bamboos.—The Japanese bamboos have held their own in the main, in spite of the dry season, demonstrating their ability to succeed without irrigation even on light soils, in ordinary years. For ornamental purposes, where a close screen, a dense thicket, or highly effective clumps of a light color are required, nothing could be better than the golden bamboo (*Phyllostachys aurea*). The canes of this handsome bamboo also have some economic value. Though small and slender (10 to 15 feet in height, and three quarters of an inch in diameter at the base), they are tough, strong, and elastic; would make excellent trout poles, and could be used in the manufacture of light articles of furniture. The light, graceful foliage is very effective in floral decorations. *Phyllostachys aurea* has grown well here, increasing rapidly, without any care whatever.

DONATIONS MADE TO THE EXPERIMENT STATION SINCE JULY, 1897.

Since the last report was issued, gifts of seeds, plants, and scions have been received from the following persons, firms, and institutions:

The U. S. Department of Agriculture, Washington, D. C.
The Royal Gardens, Kew, England.
The Royal Botanic Gardens, Calcutta, India.
The Agri-Horticultural Society, Madras, India.
The Saharanpur Botanic Gardens, Saharanpur, India.
The Botanic Garden, Georgetown, British Guiana.
The Forestry Department, Cape Town, South Africa.
The Botanic Gardens, Rio Janeiro, Brazil.
The Botanic Gardens, Buenos Ayres, Argentine Republic.
The Botanic Gardens, Sydney, New South Wales.
The Botanic Department, Brisbane, Queensland.
The National Herbarium, Melbourne, Victoria.
The Botanical Department, University of California.
The Minister of Agriculture, Mexico.
T. W. Adams, Esq., Greendale, Canterbury, New Zealand.
Vilmorin & Co., Paris.
Barr & Son, Convent Garden, London.
William Thompson, Ipswich.
Golden Gate Park, San Francisco, California.
Luther Burbank, Santa Rosa, California.
N. S. Berg, Dos Palos, Fresno County, California.
Dr. Franceschi, Santa Barbara, California.
Mrs. Theodosia B. Shepherd, Ventura, California.
George Roeding, Fresno, California.
John Rock, Niles, California.
Joseph C. Shinn, Niles, California.
W. A. Burpee, Philadelphia, Penn.
Morse Seed Co., Gilroy, California.
Dr. Lorenzo Yates, Santa Barbara, California.
Carl Purdy, Ukiah, California.
Abbot Kinney, Lamanda Park, California.
Los Angeles Park Commissioners, Los Angeles, California.
Superintendent of Riverside Park, Riverside, California.
Mr. C. Tharsing, Reform School, Ione, California.
T. V. Munson, Denison, Texas.

EXCHANGES RECEIVED AT STATION READING-ROOM.

CALIFORNIA.

Berkeley Daily Gazette, Berkeley, Alameda County.
Amador Ledger, Jackson, Amador County.
Amador Dispatch, Jackson, Amador County.
Oroville Register, Oroville, Butte County.
Chico Enterprise, Chico, Butte County.
Colusa Sun, Colusa, Colusa County.
Pinole Weekly Times, Pinole, Contra Costa County.
Fresno Weekly Republican, Fresno, Fresno County.
Willows Journal, Willows, Glenn County.
Inyo Register, Bishop, Inyo County.
Inyo Independent, Independence, Inyo County.
Lake County Bee, Lakeport, Lake County.
California Cultivator, Los Angeles, Los Angeles County.
Pacific Fruit World, Los Angeles, Los Angeles County.
Rural Californian, Los Angeles, Los Angeles County.
L'Union Nouvelle, Los Angeles, Los Angeles County.
The News, San Pedro, Los Angeles County.
Pomona Weekly Times, Pomona, Los Angeles County.
Pomona Progress, Pomona, Los Angeles County.
Pasadena Weekly Star, Pasadena, Los Angeles County.
Madera Mercury, Madera, Madera County.
Marin Journal, San Rafael, Marin County.
Dispatch-Democrat, Ukiah, Mendocino County.
Mendocino Beacon, Mendocino, Mendocino County.
Merced Express, Merced, Merced County.
Salinas Index, Salinas, Monterey County.
Gonzales Tribune, Gonzales, Monterey County.
St. Helena Star, St. Helena, Napa County.
Napa Register, Napa, Napa County.
Weekly Index-Telegraph, Grass Valley, Nevada County.
Press and Horticulturist, Riverside, Riverside County.
Citrograph, Redlands, San Bernardino County.
Chino Valley Champion, Chino, San Bernardino County.
Weekly Times-Index, San Bernardino, San Bernardino County.
Ontario Record, Ontario, San Bernardino County.
Colton Chronicle, Colton, San Bernardino County.
Colton News, Colton, San Bernardino County.
Escondido Times, Escondido, San Diego County.
Weekly Post, San Francisco.
Weekly Chronicle, San Francisco.
Weekly Call, San Francisco.
Weekly Examiner, San Francisco.

California Demokrat (German), San Francisco.
California Fruit-Grower, San Francisco.
United States Weather Report, San Francisco.
Wood and Iron, San Francisco.
Pacific Rural Press, San Francisco.
Deutsche Vereins-Zeitung (German), San Francisco.
Western Creamery, San Francisco.
San Miguel Messenger, San Miguel, San Luis Obispo County.
San Luis Obispo Breeze, San Luis Obispo, San Luis Obispo County.
Paso Robles Record, Paso Robles, San Luis Obispo County.
Times-Gazette, Redwood City, San Mateo County.
Weekly Press, Santa Barbara, Santa Barbara County.
Gilroy Gazette, Gilroy, Santa Clara County.
Pacific Tree and Vine, San José, Santa Clara County.
Pajaronian, Watsonville, Santa Cruz County.
Dixon Tribune, Dixon, Solano County.
Vacaville Reporter, Vacaville, Solano County.
Santa Rosa Republican, Santa Rosa, Sonoma County.
Healdsburg Tribune, Healdsburg, Sonoma County.
Oakdale Graphic, Oakdale, Stanislaus County.
Yreka Journal, Yreka, Siskiyou County.
Sutter County Farmer, Yuba City, Sutter County.
Corning Observer, Corning, Tehama County.
The New Era, Corning, Tehama County.
Weekly Tulare Register, Tulare, Tulare County.
Tulare County Times, Visalia, Tulare County.
Porterville Enterprise, Porterville, Tulare County.
Visalia Delta, Visalia, Tulare County.
Santa Paula Chronicle, Santa Paula, Ventura County.
Ventura Free Press, Ventura, Ventura County.

OTHER STATES.

Florida Times-Union and Citizen, Jacksonville, Florida.
Monthly Bulletin, Tallahassee, Florida.
American Farm and Vegetable Journal, Chicago, Illinois.
The Chicago Daily Drover, Chicago, Illinois.
Dairy and Creamery, Chicago, Illinois.
Elgin Dairy Report, Elgin, Illinois.
Farmers' Magazine, Springfield, Illinois.
Farm, Field, and Fireside, Chicago, Illinois.
Farm and Home, Chicago, Illinois.
Farmers' Voice, Chicago, Illinois.
Farm and Fireside, Chicago, Illinois.
Garden and Farm, Chicago, Illinois.
Hospodarske Listy (Russian), Chicago, Illinois.
National Farmer and Stockgrower, Chicago, Illinois.
Orange Judd Farmer, Chicago, Illinois.
Prairie Farmer, Chicago, Illinois.
Sugar Beet Gazette, Chicago, Illinois.
Agricultural Epitomist, Indianapolis, Indiana.
Farmers' Guide, Huntington, Indiana.
Indiana Farmer, Indianapolis, Indiana.

The Jersey Bulletin, Indianapolis, Indiana.
Dubuque Trade Journal, Dubuque, Iowa.
Farmers' Tribune, Des Moines, Iowa.
Homestead, Des Moines, Iowa.
Wallace's Farmer, Des Moines, Iowa.
Topeka Daily Capital, Topeka, Kansas.
The Southwestern Farmer, Kansas.
Louisiana Planter, New Orleans, Louisiana.
Turf, Farm, and Home, Waterville, Maine.
Baltimore Weekly Sun, Baltimore, Maryland.
The Ruralist, Gluckheim, Maryland.
Southern Farm Magazine, Baltimore, Maryland.
Farm Poultry, Boston, Massachusetts.
American Cultivator, Boston, Massachusetts.
New England Farmer, Boston, Massachusetts.
North American Horticulturist, Monroe, Michigan.
The Michigan Sugar Beet, Bay City, Michigan.
Market Garden, Minneapolis, Minnesota.
The Golden Egg, St. Louis, Missouri.
Western Fruit Grower, St. Louis, Missouri.
Edwards' Fruit Grower and Farmer, Missoula, Montana.
Weekly Union, Manchester, New Hampshire.
Mirror and Farmer, Manchester, New Hampshire.
New Mexico Review, Santa Fé, New Mexico.
Vick's Magazine, Rochester, New York.
American Agriculturist, New York City, New York.
Bonfort's Vine and Spirit Circular, New York City, New York.
The Strawberry Specialist, Kittrell, North Carolina.
American Grange Bulletin, Cincinnati, Ohio.
Gleanings in Bee Culture, Melina, Ohio.
Woman's Home Companion, Springfield, Ohio.
Northwest Pacific Farmer, Portland, Oregon.
Oregon Agriculturist, Portland, Oregon.
Germantown Telegraph, Germantown, Pennsylvania.
Public Ledger, Philadelphia, Pennsylvania.
Practical Farmer, Philadelphia, Pennsylvania.
Sugar Beet, Philadelphia, Pennsylvania.
Successful Farmer, Sioux Falls, South Dakota.
Texas Farm and Ranch, Dallas, Texas.
Texas Stockman and Farmer, San Antonio, Texas.
The Southern Planter, Richmond, Virginia.
Holstein-Friesian Register, Brattleboro, Vermont.
Northwest Horticulturist, Tacoma and Seattle, Washington.
West Virginia Farm Review, Charleston, West Virginia.
Mind and Body, Milwaukee, Wisconsin.
Hoard's Dairyman, Fort Atkinson, Wisconsin.
Farmers' Magazine, Madison, Wisconsin.
The Farm Magazine, Milwaukee, Wisconsin.

FOREIGN.

The Agricultural Journal and Mining Record, Maritzburg, South Africa.

The Agricultural Journal, Natal, South Africa.

Bulletin de la Direction de l'Agriculture et du Commerce, Tunis, Algiers.

Bulletin Agricole de L'Algerie et de la Tunisie, Mustapha, Algiers.

The Agricultural Gazette of New South Wales, Adelaide, Australia.

The Hawkesbury Agricultural College Magazine, Richmond, N. S. W., Australia.

Queensland Agricultural Journal, Australia.

Journal of Agriculture and Industry, Adelaide, South Australia.

Tiroler Landwirtschaftliche Blätter, S. Michele, Austria.

Field and Garden, Australia.

The World, Vancouver, B. C., Canada.

The Coöperative Farmer, Sussex, N. B.

The Canadian Horticulturist, Grimsby, Ontario.

Mark Lane Express, London, England.

Bulletin de la Société Nationale d'Acclimatation de France, Paris, France.

Bulletin du Ministere de l'Agriculture, Paris, France.

Revue des Cultures Coloniales, Paris, France.

Deutsche Landwirtschaftliche Presse, Berlin, Germany.

Agriculturist, Japan.

The Popular Agriculturist, Tokyo, Japan.

Bolletin Mensual del Observatorio Meteorologico Central de Mexico.

The Agricultural Gazette, Hobart's, Tasmania.

Planting Opinion, Madras, India.

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The May Rock, Mariposa County.

Croppings of the Eagle-Shawmut Mine, Tuolumne County.

CALIFORNIA STATE MINING BUREAU.

A. S. COOPER, State Mineralogist.

BULLETIN No. 18. San Francisco, October, 1900.

THE

Mother Lode Region of California.

By W. H. STORMS, E.M.

Published under the Direction of HENRY T. GAGE, Governor of the State of California.

SACRAMENTO:
A. J. JOHNSTON, : : : : SUPERINTENDENT STATE PRINTING.
1900.

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LIST OF ILLUSTRATIONS.

LETTER OF TRANSMITTAL.

San Francisco, Cal., September 30, 1900.

To His Excellency Henry T. Gage, *Governor of the State of California*; The Honorable The Board of Trustees of the California State Mining Bureau; *and* Hon. A. S. Cooper, *State Mineralogist*.

Gentlemen: I have the honor to submit herewith the report of my investigation of the mines of the Gold Belt in El Dorado, Amador, Calaveras, Tuolumne, and Mariposa Counties during the spring and summer of 1900. I regret that the necessity of visiting some of the northern counties of the State during June and July made it impossible to complete the work during the season, but, as it is a field of active operation, the coming year will find development further advanced, and at that time the investigation may be continued with more satisfactory results than would have been obtained had the work been done the past season. Very few other than operating mines were visited, and of these the description in this bulletin is limited to the most important ones, the others appearing in a general report which shortly follows this bulletin.

I find among the more progressive superintendents and mine managers a disposition to experiment with a view to improving mining methods and to decreasing the expense of treating ore, and as a result we find not a few innovations which in most cases will be adopted in general practice, with such further improvements as additional experience may suggest.

It affords me great pleasure to state that the mine owners, managers, and superintendents, almost without exception, spared neither time nor trouble in affording every facility for investigation of the mines under their direction, which made the task not only light, but pleasant.

I am, yours respectfully,

W. H. STORMS.

THE MOTHER LODE REGION OF CALIFORNIA.

By W. H. STORMS, E.M.

The California Gold Belt has furnished a most interesting field for geological research ever since its discovery in 1849. It has received the attention of many geologists, and a great deal has already been published concerning it. Among the most noted and valuable of these contributions to our knowledge of the Gold Belt are the early writings of Dr. Rossiter W. Raymond and Ross E. Browne, and more recently those of H. W. Fairbanks and Ross Browne, and the exhaustive maps and reports of the United States Geological Survey. The various reports of the State Mining Bureau have also furnished a large amount of valuable technical and statistical information on the subject.

In consideration of the very large amount of descriptive matter already published concerning the mines of the Gold Belt, or Mother Lode, it was with the feeling that the subject was worn somewhat threadbare that the writer undertook the re-investigation of this important mining field in January, 1900.

Since the publication of the XIIIth report of the State Mineralogist in 1896, no publication has been issued by the State regarding the progress of work in the counties along the Gold Belt, though this period has been one of unusual activity and progress and also of innovation in these mines. Old methods have in many cases given place to more modern ideas, and still more radical changes may be anticipated in the near future.

An era of deep mining has commenced which can only be carried to the greatest success by the adoption of modern mining methods and improved machinery, together with a closer attention to the economical treatment of the ores. Already it has been shown that mines which were worked in former years under disadvantages and at an expense considerably above that now necessary to accomplish given results, after years of idleness, upon being reopened and equipped with modern machinery, can again be made to yield a handsome profit, where formerly some of them were worked at a loss.

This has been made possible by the reduced cost of labor in later years; by the superior efficiency of nitro powders over the black blast-

ing powders used formerly in all mining operations in this State; by better and cheaper mining supplies of all kinds; and in no small degree, by improved hoisting, pumping, and milling machinery, and to some extent also by improved mining methods.

There is little doubt that the marked mechanical success attending very deep mining elsewhere, notably in the Lake Superior copper mines and in the gold mines of South Africa, has proven a great incentive to the miners of California to emulate, in a measure at least, these splendid efforts, and we now find large vertical shafts being sunk to a depth far exceeding anything heretofore attempted in California mines.

There are mines in Amador and Nevada Counties now operating to a depth of 2500 feet or more through old inclined shafts, usually sunk to conform to the dip of the vein, or approximating it, and there are numerous mines in several mining counties where inclined shafts are down 1500 to 2000 feet. The managers of these properties realize the importance of having shafts sunk at a uniform angle—whether vertical or inclined—thoroughly equipped and provided with the best hoisting machinery in order to reduce the cost of mining to a minimum, for in nearly all of the large mines it is known that there are immense bodies of low-grade ore, too poor to pay when worked by old methods, but which would afford a good profit if mined by modern methods and with well-equipped shafts and machinery of proper construction. This matter will be more fully discussed under the title of "Methods of Mining."

The introduction of extensive slimes plants, and the successful operation of the cyanide process in its various forms, have also contributed in a measure to increased financial success, and electric plants have also been installed at several points for the distribution of power to mines along the Gold Belt. These installations are said to be successful financially as well as mechanically. Transmission of power through the medium of compressed air, though not an innovation, is more extensively employed than formerly.

GENERAL GEOLOGY OF THE GOLD BELT.

Owing to the extremely complicated structural geology of the California Gold Belt, positive assertions as to the relative age of the intrusive rocks which so commonly occur throughout its length are generally unsafe, but in a general way it may be stated that, upon rocks of an uncertain but very great age, possibly Archæan, there was laid down in Palæozoic time a deep series of sediments consisting of mud, sand, finely comminuted calcareous fragments, calcareous ooze, etc. Following this there was evidently a long period of volcanic activity, during which there was accumulated a vast quantity of basic rocks, chiefly diorite and diabase, and basic tuffs and breccias. These rocks are mineralogically closely allied to the andesites, and are called the old andesites by the United States Geological Survey. The underlying formations, together with the tuffs, were consolidated into rock; the mud being transformed into shale, and by further process of metamorphism, into slate, the sand becoming quartzite, and the calcareous material, limestone.

There were evidently successive periods of elevation and subsidence also, resulting in the formation of extensive beds of conglomerate along the shore lines. During the Jurassic age there was deposited upon these older formations a stratum of fragmentary material consisting of fine silt and sand, forming eventually thick beds of shale and sandstone.

During a portion of this period volcanic activity was again pronounced, particularly about the close of the period, during which there was again accumulated a large amount of diabase tuffs and breccias. In some localities the mud deposits and the tuffs are found interbedded, showing that the volcanic outbursts were intermittent. In some cases a sandstone is found wholly made up of diabase material, and this is probably the result of the disintegration of some previously erupted material, which was carried down from an elevated ridge and deposited in the bed of the sea. These sediments have subsequently been uplifted, folded, crushed, and faulted. The dynamic forces were still at work, and large dike-like masses of diabase, diorite, serpentine, and other intrusive rocks were thrust from below into the complex of older rocks.

The Palæozoic rocks, owing to their large development in Calaveras County, have been named the Calaveras formation, and the later deposits of Jurassic age have been called the Mariposa beds (as this formation is most extensively exposed in Mariposa County), and it is in more or less close association with these beds that the so-called Mother Lode of California occurs.

Lying to the eastward of the above described formations is found a broad expanse of intrusive rock, which, owing to its peculiar mineral-

ogical character, has been named grano-diorite. At numerous points along the contact of the grano-diorite with the formations heretofore mentioned there is found abundant evidence that the grano-diorite was intruded later than the greenstones, and it is also later than the Mariposa beds. There is some reason to believe that the grano-diorite is as late as the Cretaceous.

The Mariposa beds appear generally to occupy a position along the trough of a synclinal fold, the Calaveras formation being found both to the eastward and westward of the Mariposa beds. The occurrence of the diabase tuffs and the intrusion of great masses of basic dike rock (diabase and diorite) have rendered the positions of the Mariposa beds and the Calaveras formation very irregular and often extremely puzzling, as the distribution of the tuffs, breccias, and intruded dikes is most erratic. It is more than probable that a cross-section taken every half, or even every quarter mile along the Gold Belt, would show an entirely different structural condition.

The Schists and Metamorphic Rocks.—The tremendous compressive stress to which these rocks have been subjected since their uplift, has resulted in the formation of a series of highly crystalline metamorphic rocks—the mud being altered into slates, the sandstones changed to quartzite, and not infrequently the limestones are found altered to marble. The greenstones have likewise been changed over broad areas. The pressure and movement accompanying it have resulted in many cases in a complete obliteration of the original character of the normal rocks, and in place of the crystalline granular greenstones we find schists and slates (the amphibolite schist of the United States Geological Survey). Throughout the entire length of the Gold Belt are found greenstones of greatly varying texture (chiefly diabase), which have suffered little or no alteration.

These masses of greenstone are from a few feet to several hundred feet in width, and it seems not improbable that they were mostly intruded since the formation of the schists. In some instances this is positively known to be the case, as they are found cutting the schists in strike and dip. In some of the gold mines these greenstone dikes may also be clearly seen to be more recent than the inclosing rocks, and occasionally they are found intersecting the quartz veins.

Instances may be observed, however, where only portions of certain massive formations are schistose, and this can only be attributed to the local effect of the dynamic forces similar in character to those which produced the original metamorphism of the older formations. The general features of the schistose greenstones (both massive and tufaceous) occurring in California are so similar physically to those of the Marquette and Menominee regions of Michigan that there seems no room to

doubt that in each case similar causes operated to produce like effects. The Michigan region has been studied with great care by several of the best geologists of America. Those interesting rocks and the manner of their formation have been fully described by G. H. Williams, and a few extracts are taken from his excellent contribution to this important subject, the dynamic metamorphism of eruptive rocks,* for the reason that they apply so perfectly to the conditions found in California along the Gold Belt, and I have not the slightest doubt that greenstone schists, wherever found, whether as the result of the alteration of massive greenstone tuffs or of fragmental rocks (sandstones), derived from the degradation of older greenstones, are the direct result of the causes ascribed by Mr. Williams as having produced the schists of the Michigan region.

In referring to the value of the microscope in the study of metamorphism of rocks, Mr. Williams says:

> The most important problems presented by an unaltered massive or igneous rock relate to (1) its chemical composition, and (2) to the conditions under which it was formed. The composition expresses itself in a general way, in the nature of the component minerals, while physical conditions attendant upon the formation of the rock may be traced in its structure. Each of these has therefore been, in turn, the particular object aimed at during the first two periods of petrographical research.
>
> But if petrography were able to solve satisfactorily all the problems presented by the unaltered massive rocks, it would even then be prepared only to commence its most difficult and most important mission. Rocks are in reality far from being dead, inert, stationary masses, which they appear to the ordinary observer. The fascinating study of chemical geology, especially when aided by the microscope, shows them to be in a state of almost constant change. It is true that some of the oldest rocks seem to have suffered hardly any alteration since they were first formed, but most of them are ever-active laboratories where old products are being pulled to pieces and new ones built up. The tracing-out of such changes is an important aim of petrography in its present stage.

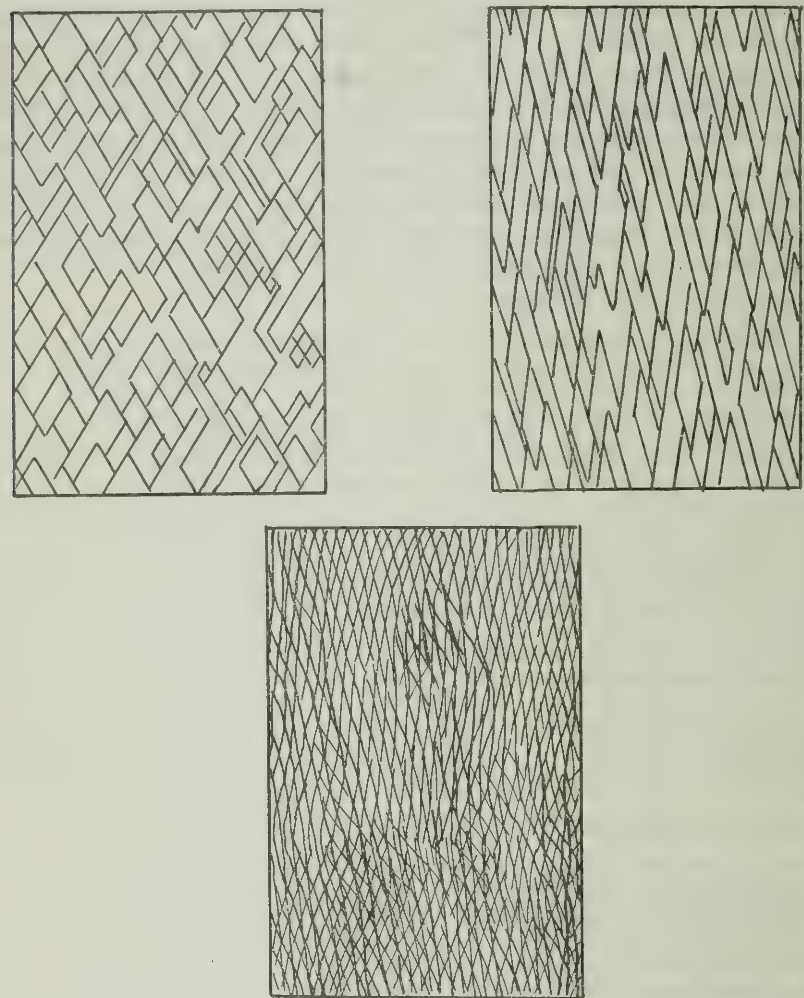
In the study of the structural geology of the California Gold Belt, it was found necessary to employ the microscope, and the conclusions reached in this study are identical with those submitted by Mr. Williams. Upon his study in the Michigan area, continuing, he says:

> There are two distinct kinds of alterations which take place in a solid rock mass, dependent, of course, on the nature of the changed physical conditions. These are:
>
> (1) Metamorphism; or the passage, under circumstances of high temperature or pressure, or both, of less crystalline into more crystalline compounds; or the change of minerals into others not less crystalline or insoluble than themselves.
>
> (2) Decomposition or weathering; the passage, under ordinary atmospheric conditions, of crystalline rock constituents into compounds less crystalline and more soluble than themselves. This is accomplished generally by hydration or carbonization.
>
> Both of these processes are frequently seen to have gone on in succession in the same rock mass, the latter more or less completely effacing the effects of the former. While distinct, both processes agree in being atomic and molecular rearrangements in a solid mass, necessitated by some change in external conditions. The differences in these conditions, however, produce widely different results; and all of these again are essentially different from those produced by the solidification of a liquid magma.
>
> The student of the crystalline rocks can distinguish, in a general way, four classes of

*Bulletin No. 62, United States Geological Survey. "The Greenstone Schist area of the Menominee and Marquette regions of Michigan."

constituent minerals, and this is true in spite of the fact that the same species may be represented in two or more of these classes:

(1) Original minerals of the acid rocks, formed by the solidification of a magma in a state of aqueo-igneous fusion or by the aid of mineralizers; e. g., quartz, orthoclase, mica, zircon, etc.



Diagrams illustrating the transition from jointing to schistose structures in the greenstones.

Fig. 1.

(2) Original minerals of the basic rocks, formed from a state of dry fusion; e. g., plagioclase, augite, olivine, etc.

(3) Metamorphic minerals, formed as above explained, from originals; e. g., hornblende, albite, biotite, zoisite, garnet, staurolite, andalusite, etc.

(4) Decomposition minerals; e. g., chlorite, quartz, carbonates, hydroxides, etc. * *

Rocks may be altered by simple pressure, but the accumulated strains which are generated within them are relieved and adjusted by overcoming the force of cohesion along certain planes. Here there will be a shearing motion of greater or less extent, and a consequent crushing of the rock. The rent is soon healed by the crystallization of new compounds which cement the crushed fragments, and in this way a schistose band, of width varying with the intensity of the force, may be developed in the midst of an otherwise solid and massive rock; or a number of such bands may be formed parallel to one another and together imparting to the rock the appearance of a foliated or even a banded schist.

Conclusive proof of this process might be difficult to discover without the aid of a microscope, but this instrument is happily able to afford sufficient evidence to overcome all doubt. * * *

The first step toward the formation of a schistose structure in Twin Falls greenstones (and this is hardly ever absent) is the division of the massive rock by two systems of joints, which stand about perpendicular to the surface and intersect at a varying but acute angle. These joint systems divide the mass into diamond-shaped or rhomboidal prisms, the cross-sections of which are well displayed upon the frequent smoothly glaciated surfaces of the rock. The appearance of such a surface is diagrammatically represented in Fig. 1.

As we approach the schistose band in the massive rock these interlacing rhombs become lengthened out more and more by an approximation to parallelism between the two systems of joint planes.

These elongated prisms finally become very much extended lenses, which interlock and produce a well-developed, wavy, or even parallel schistose structure. The almost slaty rocks thus produced, especially as seen at Lower Twin Falls, have a tendency to break, not so much along a definite plane, as parallel to a line—i. e., the direction, normal to the surface, parallel to which the original joint planes ran. It is difficult to obtain well-shaped hand-specimens of these rocks, but narrow rhombic prisms of almost any angle are easily procured. There is an almost equal tendency to cleave along any plane which is parallel to the longest axis of these prisms.

If the prisms due to the original joint planes were subjected to a lateral pressure which developed in them a cleavage that successively approached more and more nearly to the long axis as the prism was lengthened, this peculiar tendency to separate along a line rather than along a plane is precisely the structure which we might suppose would result.

The strike of these schistose bands follows the direction which bisects the acute angle of the rhombic prisms. This is for the most part from S. 70° to 80° E.; agreeing with the prevailing strike of all the rocks in this system. There are, however, many exceptions where these schistose bands, even where near together, follow different directions; for instance, I observed in the massive though jointed rock on the Michigan side of Upper Twin Falls, two schistose chloritic bands quite near together, one having a strike N. 180° E., and the other S. 73° E., while the dip of each was nearly vertical. Such cases are easily explicable on the supposition that these bands were produced by mechanical agencies, but it is quite impossible to reconcile them with the supposition that these bands are in any way the result of sedimentation.

It is not infrequently noticed that there is a local development of schistose structure of massive rocks in the immediate neighborhood of fissures and veins. A typical instance of this character may be observed on Wood's Creek, a few hundred feet below the pumping-station, near the Bonanza Mine at Sonora, in Tuolumne County. Here a quartz vein, about twelve inches in width, traverses a hard, dark-green diorite. The walls on either side are altered for a width of three to five feet, being soft talcose or chloritic schist near the vein, and passing over by transition to the normal diorite. These occurrences are not at all uncommon, though often of local character.

In Amador and Calaveras Counties, and also to some extent in El Dorado County, I found peculiar banded schists, which have attracted the attention of many geologists. Similar banded schists occur in the Michigan area, above referred to, of which Mr. Williams speaks as follows:

The banded greenstone schists which form the prevailing rock over the northern portion of the Marquette area, have been regarded by all geologists who have ever studied them, as originally sedimentary deposits, and repeated examination of them in the field seems incapable of leading to any other conclusion. They are everywhere stratified with the greatest regularity in bands of lighter and darker shades of green. This structure is to be most advantageously seen in the woods just north of Marquette and near Lighthouse Point. Here glaciated areas of considerable extent often show a finely ribboned appearance, looking as though the sharp parallel lines had been drawn with a ruler. The alternation in the composition of the layers is so frequent and so constant, and their parallelism to the east and west strike of all the rocks in this neighborhood is so exact, that no hypothesis of their originally massive character will satisfactorily account for the observed facts. * * *

On the other hand, their chemical as well as their mineralogical composition renders it impossible to separate them from the massive and highly altered greenstones (uralite diabases, etc.), with which they are most intimately associated. Their parallel banding indicates a fragmental, but their chemical and their mineral composition indicate an igneous, origin. The only satisfactory reconciliation of these opposite sets of characters is to be found in that group of rocks intermediate between sediments and lavas, known as volcanic tuffs.

In the opinion of the writer, then, the banded greenstone schists of the northern Marquette area are to be regarded as consolidated and highly metamorphosed diabase tuffs. These are intimately associated with the numerous contemporaneous flows of diabase and quartz porphyry, together with the tuffs of the latter rock; while all have been broken through by much younger dikes, both basic and acidic.

* * * * * * * * * * * *

In order to obtain a clear idea of just how these ancient and much disguised tuffs acquired their present form and apparently dual character, it will be advantageous to ascertain what is known of analogous formations of comparatively recent date. Captain C. E. Dutton's descriptions of the fragmental rocks accompanying the Tertiary eruptives of the high plateaus of Utah are well suited to this purpose. He says, in speaking of the extent of these deposits:

"Some of the most interesting lithological problems presented by the volcanic products of the high plateaus are those relating to the origin and development of what may be termed the clastic igneous rocks, or rocks apparently composed of fragmental materials of igneous or volcanic origin, but now stratified either as so-called tufaceous deposits or as conglomerates. These are exceedingly abundant in all of the great volcanic districts of the world, and often enormously voluminous.

"How those of the high plateaus would compare, in respect to magnitude, with those of other regions, I do not accurately know, but absolutely their bulk is a source of utter astonishment. They cover nearly 2000 square miles of area, and their thickness ranges from a few hundred feet to nearly 2500 feet, the average being probably more than 1200 feet. Lavas are frequently intercalated, but much more frequently no intercalary lavas are seen, and in general they seldom form any large proportion of the entire bulk when they occur in conjunction with the clastic masses."

Again, in speaking of the peculiar liability of such deposits to metamorphism, the same writer says:

"A very striking characteristic of these clastic volcanic rocks, both the tufas and the conglomerates, is their great susceptibility to metamorphism. Not only have the beds in many localities been thoroughly consolidated, but they have undergone crystallization. These tufas and conglomerates, which are of older date, and which have been buried beneath more recent accumulations to considerable depths, rarely fail to show

conspicuous traces of alteration, and in many cases have been so profoundly modified that for a considerable time there was doubt as to their true character.

"The general tendency of this process is to convert the fragmental strata into rocks having a petrographic facies and texture very closely resembling certain groups of igneous rocks. When we examine the rocks in situ, no doubt can exist for a moment that they are water-laid strata. The hand-specimens taken from the beds, which are extremely metamorphosed, might readily pass, even with close inspection, for pieces of massive eruptive rocks, were it not for the reason that the original fragments are still distinguishable, partly by slight differences in color, partly by slight differences in the degree of coarseness of texture. But the matrix has become very similar to the included fragments, holding the same kinds of crystals, and under the microscope it shows a ground-mass of the same texture and composition."

The Alteration of Other Massive Rocks.—The greenstones are not the only massive rocks which have undergone a more or less complete alteration in the region of the Gold Belt. There are two rocks in particular to which I wish to call attention. These are the calcareous rocks which constitute the great dolomitic vein, previously referred to, and a dark green, massive, extremely hard, and tough rock found at numerous places along the Gold Belt, notably in Calaveras County just east of San Andreas; near Dogtown, three miles from Angels; at Smith's Flat, west of Angels, and elsewhere. The ankerite or dolomite vein is usually distinguished by its great width and massive character, and the occurrence of more or less abundant mariposite; but in many places we find this hard, thoroughly crystalline rock has been compressed, sheared, and completely altered, passing over by gradual transition to typical soft talc schist.

A series of transition rocks of this character was obtained at the Pacific Mine, Placerville, El Dorado County, and is on exhibition in the Museum of the State Mining Bureau in San Francisco. Similar occurrences have been noted in a score of mines, from Mariposa County northward as far as Placerville, but collections from other mines have not been placed upon exhibition, because the occurrence is essentially the same in each case, and the space available in the Mining Bureau is already crowded.

Concerning the other massive rock, hand-specimens were selected from the Ford Mine at San Andreas, also from a similar occurrence at the Smyth Mine near Angels, and slides cut for microscopic study. These prove the rock to consist of a matted aggregate of minute scales of talc, with a little calcite and magnetite. The rock, although the freshest obtainable, is very evidently not in its normal condition, but is an igneous rock which has already undergone considerable change. It may have been a gabbro or some allied eruptive rock, which, by a process of compression and shearing previously described, is now found changed into a typical massive crystalline granular or schistose steatite (soapstone). Undoubtedly, the alteration of massive rocks to a schistose or slaty condition is very much more common than is generally

supposed, but unfortunately too little attention had been given in the past to these phenomena.

It has been noticed in several instances where mine workings have been extended into the steatite masses, that not infrequently the rock is found to consist of a coarsely crystalline aggregate of semi-schistose, calcareous and magnesian minerals and to greatly resemble the partly altered ankerite and dolomite found along the Central Gold Belt. Notable instances may be found in the Ford Mine at San Andreas in Calaveras County, and at the Spanish Mine near Forest Hill in Placer County. As these rocks approach so nearly the dolomite of the Central Gold Belt, they may be considered as indicating the possible origin of the dolomitic veins from basic eruptives.

THE SEVERAL DIVISIONS OF THE GOLD BELT.

Throughout the entire length of the great synclinal trough of the Gold Belt are found the gold-bearing veins which constitute the so-called Mother Lode. It seems unfortunate that the name was ever given to this portion of the Gold Belt, as it conveys to the minds of those unfamiliar with the geological structure and veins of the region, an impression of a continuous, unbroken vein. That such a condition does not exist is well known to those familiar with these mines.

There are through that portion of the State occupied by the counties extending from Mariposa on the south to the southern portion of El Dorado County on the north, at least four distinctly recognizable gold belts: That which skirts the low foothills along the Great Central Valley includes the copper deposits found at and near Green Mountain in Mariposa County, and southward in Madera County, those at Copperopolis and at Campo Seco in Calaveras County, and at Ranlett in Amador County, and also the gold mines of Salt Spring Valley in Calaveras County. It may also be considered as embracing the gold mines near Hornitos in Mariposa County, and those near Ione in Amador County.

East of this a distance of 8 or 10 miles is found the most important gold-bearing belt of the State, which has received the name of "Mother Lode." This, it seems to me, it would be well to designate as the Central Lode of the Gold Belt. It must be understood and remembered in this connection that the gold-bearing veins are nowhere absolutely continuous and unbroken for a great distance, but that the so-called lode is frequently interrupted by its absolute disappearance for considerable distances.

Lying east of the Central Lode, in Mariposa County, a distance of nearly 20 miles, and extending in a northwesterly direction, nearly

parallel with the Central Lode, and passing through Tuolumne and Calaveras Counties, is the third gold-bearing lode, which in Amador County has approached to within 6 to 10 miles of the Central Lode. This is known as the East Lode, and embraces many interesting and important mines.

Still farther eastward lies at least one mineral belt which has been opened at several points, but of which comparatively little is known as yet. This might properly be named the Sierra Lode.

It is the intention to fully investigate this important field in the future, as it is one of great promise. The veins are large, and carry sulphides of iron, lead, zinc, and copper, and also gold and silver.

The Central Gold Belt.—It is with the Central Gold Belt we have chiefly to deal in this Bulletin, as lack of time precluded a thorough investigation the past season of the entire region comprising the Gold Belt.

For years, in fact since its early history, the clay slates of the Mariposa beds have been considered an absolutely essential feature and accompaniment of the important gold mines of the Central Gold Belt. The veins have been referred to as "contact veins," and in many sections the immediate contact, or close proximity, of the Mariposa clay slates has been deemed indispensable to pay rock.

Such, however, is apparently not the case in Amador County, where are situated the deepest and most productive mines. While it is possible that some of these mines are confined wholly to the Mariposa clay slates, or occur at contact of the Mariposa clay slates and massive greenstones, or the amphibolite schists resulting from their alteration, if such be the case the instance is unknown to the writer, for without exception, the large number of accessible mines prove that the Mariposa *clay* slates form really no important feature as related to ore deposition, while thus far in Amador County, south of Plymouth, all development confined to the typical clay slates of the Mariposa beds has proven the fissures in that formation valueless, and these developments reach many thousands of feet of shafts and drifts.

The fissures in which the ore deposits occur along the Central Lode, with no exception, so far as the writer is aware, cut the dip and usually, also, the strike of the inclosing rocks. The dip of the slaty and schistose formations is uniformly to the eastward, though at greatly varying angles, but usually between 50 and 80 degrees, while the dip of the vein fissures is always somewhat less in approximately the same direction.

In the mines of Amador County are found a peculiar black slaty rock, often approaching closely in physical appearance the clay slates of the Mariposa beds. They may usually be readily distinguished by a peculiar pitted appearance. This feature ranges from rather coarse,

thickly scattered, knotty granules, to the fine dots resembling pin pricks—the finer grained and the more slaty in structure the rock, the finer are the pits.

For years these rocks have not been distinguished from the black clay slates of the Mariposa beds, but the writer noticing that this peculiar slaty rock was of persistent occurrence with the most important ore-bodies of Amador County, determined to ascertain if possible what, if any, difference there was between these pitted slates and the smooth, satin-like slates of the Mariposa beds. With this object in view, several series of rocks were collected at various mines, showing complete transition from a massive or slightly schistose rock to a perfect black slaty rock, the specimen always showing the pits as above described, and being obtained from certain cross-cuts where the transition was evident.

These rocks were placed in the hands of H. W. Fairbanks, of Berkeley, who prepared slides and carefully studied them with the aid of the petrographical microscope. This investigation resulted in proving that these peculiar slates and schists were the result of the shearing and alteration of tuffs (evidently diabase), and that the rock was originally of fragmentary origin, though made up of diabase material (augite, plagioclase, etc.). Their character is rendered perfectly evident under the microscope, and the change from one phase of alteration to the next may be clearly traced in the several rock sections.

CLASSIFICATION AND DESCRIPTION OF ROCKS

Collected by W. H. Storms along Central Gold Belt.

Determinations made by H. W. Fairbanks, A.B.

Nos. 1 to 9, inclusive, From cross-cut 900-level, Keystone Mine, Amador County.
No. 10. From tunnel east of Keystone Mine, Amador County.
No. 11. From tunnel east of Keystone Mine, Amador County.
No. 12. From west wall of Oneida Mine, Amador County.
No. 13. From west wall of Oneida Mine, Amador County.
No. 14. From east shaft of Kennedy Mine, Jackson, Amador County.
No. 15. From east shaft of Kennedy Mine, Jackson, 900-level, Amador County.
No. 16. From hanging-wall of Bunker Hill Mine, Amador County.
No. 17. From Baliol Mine, Sutter Creek, Amador County.
No. 18. From west wall of Argonaut Mine, Amador County.
No. 19. From Carson Creek, Calaveras County.
No. 20. From dike in Copperopolis Mine, Calaveras County.
No. 21. From dike in Commodore Mine, San Andreas, Calaveras County.
No. 22. From Ford Mine, San Andreas, Calaveras County.
No. 23. From Ford Mine, San Andreas, Calaveras County.
No. 24. From Smyth Mine, Angels, Calaveras County.
No. 25. From Smyth Mine, Angels, Calaveras County.
No. 26. From Pocahontas Mine, Logtown, El Dorado County.
No. 27. From German Mine, El Dorado County.
No. 28. From German Mine, El Dorado County.
No. 29. From German Mine, El Dorado County.
No. 30. From hill north of Church-Union Mine, El Dorado County.
No. 31. From hill north of Church-Union Mine, El Dorado County.
No. 32. From hill north of Church-Union Mine, El Dorado County.
No. 33. From hill north of Church-Union Mine, El Dorado County.

Nos. 1 to 9, inclusive, are from the 900-foot level of the Keystone. Some of these have been supposed to be dikes, but Mr. Storms is unable to tell from the section given where the igneous rock ends and the supposed slate begins. A microscopic study of these rocks shows that in all probability they are all of sedimentary origin, a series of tuffs and slate, the tuffs being fragmental greenstones or diabases.

No. 1. This rock to the unaided eye has every appearance of being a dike. Porphyritic crystals of augite are embedded in a fine green matrix. Under the microscope this rock has the appearance of being a tuff. The constituents are badly decomposed crystals of augite and cloudy masses of feldspar in a finely granular base. Granular magnetite is present.

No. 2. To the eye this rock clearly betrays its tufaceous character. Its components are arranged in irregular layers. Under the microscope the tufaceous character is also seen. Augite crystals, granular magnetite, and cloudy tabular areas make up the rock. A large part of the matter of the rock is indeterminable, but there is no doubt that it is a diabase tuff.

No. 3. In the hand-specimen, this rock shows its clastic origin in the alternating layers of greenish and argillaceous material. The green is probably tufaceous, and the black of the same composition as the slates. Both show signs of metamorphism in the presence of a pitted surface caused by little crystals. The exact nature of these could not be determined, but in all these slates they are characteristic of metamorphic action. Under the microscope this rock does not show clearly its origin. It might be either a sedimentary rock or an altered igneous one. It is made up of ragged, clear, and cloudy areas. A green mineral has the appearance of secondary hornblende. There are some augite grains. This is a fine-grained rock.

Nos. 4, 5, 6, 7, 8, and 9. These are all black slate. In section they are practically opaque. In some there are little crystals with clear borders and dark centers, crystals produced by metamorphism.

No. 10. This rock might be taken for a fine-grained eruptive greenstone, but under the microscope it has much the appearance of being a fragmental greenstone. The rock is much decomposed, but contains a large amount of augite and considerable granular iron ore. It is somewhat schistose, the crystals and cloudy masses being arranged along parallel lines. It is quite likely a fragmental rock.

No. 11. Also an augitic tuff. The rock mass is made up largely of augite crystals thickly matted together with cloudy material and granular magnetite. The cloudy material in these tuffs may have been originally the mud resulting from the grinding up of diabase fragments.

No. 12. This is an augite porphyrite, generally termed diabase or greenstone. The rock is much decomposed; shows prominent crystals of augite, but the feldspars have almost completely disappeared in a greenish, cloudy mass.

No. 13. Diabase or augite porphyrite. This is a fresher rock than the last, but of the same general character originally. It contains large crystals of augite, and smaller ones of feldspar in a cloudy decomposed ground-mass. The rock is somewhat talcose.

No. 14. This is a medium-grained diabase. Under the microscope it appears to consist largely of augite, with some small decomposed crystals of feldspar and iron ores.

No. 15. This is a fine-grained diabase tuff, and quite schistose. It is made up of augite grains, and faintly polarizing masses are arranged in layers with opaque seams between them.

No. 16. This is probably a greenstone tuff. It contains much cloudy matter, augite crystals, others which were once feldspar, and some which resemble hypersthene. Magnetite scattered through the rock.

No. 17. This is a talcose schist derived from what was probably a fragmental greenstone or tuff. The body of the rock is made up of thickly matted rods and scales of talc.

No. 18. Coarse diabase. This rock contains an excess of augite crystals fairly fresh in character, and a cloudy base in which outlines of feldspar crystals can be made out. It has been rendered schistose through pressure.

No. 19. Layers of augitic tuff and dark slate. Under the microscope the layers are seen to be made up of cloudy indeterminable material, through which are scattered fragments of augite crystals. They make up half of the rock. The dark bands contain

less augite and stringy opaque matter. They have the character of some of the slates except for the scattered augite fragments.

No. 20. In the hand-specimen, Nos. 20 and 21 look much alike. The rocks are coarse grained, with their dark constitutents altered to a green scaly talcose mineral. They contain much feldspar and cubes of iron pyrite. Under the microscope No. 20 is seen to consist of an acid plagioclase feldspar, perhaps oligoclase, quartz, and a green mineral replacing hornblende, also magnetite. This is a much decomposed rock, but might be termed a quartz diorite.

No. 21. Under the microscope this rock is seen to consist of a decomposed feldspar similar to No. 20, and green chloritic matter replacing some dark silicate, probably hornblende. This rock is also a diorite.

No. 22. This is a massive green rock made up of an aggregate of fine talcose scales. Under the microscope it appears very similar to No. 24, but shows no clue to its original mineralogical constitution.

No. 23. This is a green rock, which in the hand-specimen is almost massive; made up of an aggregate of fine lustrous scales. Under the microscope the rock is seen to consist almost entirely of a matted aggregate of interlacing scales with the properties of talc. There is also a little calcite and magnetite. This rock, then, is mainly a hydrous silicate of magnesia, replacing some magnesia-rich igneous rock. The precise nature of this rock cannot be told, for all traces of the original constituents have disappeared.

No. 24. This is a green talcose rock, showing dark gray and light green patches; the latter were probably once feldspar and the rock originally a gabbro. Under the microscope it appears to be made up of an interlacing matte of talcose scales.

No. 25. This is a coarse rock, and to the unaided eye appears to be made up of feldspar and chloritic hornblende. Under the microscope it appears to be made of cloudy feldspar, magnetite, and augite, partly altered to green hornblende. Might properly be termed a diorite, although it was once a gabbro when in a fresh condition.

No. 26. This is a feldspar porphyry, with bronze-colored crystals of mica. Under the microscope the feldspar is seen to be plagioclase. The rock may have contained augite once. Strictly, it might be termed a diorite porphyrite.

No. 27. This rock is very similar to No. 28. It contains more augite, and is quite fresh.

No. 28. This is a grayish rock, with rather indistinct porphyritic crystals of feldspar. Under the microscope it shows porphyritic crystals of augite and feldspar in a fine granular ground-mass. This rock is very different from the greenstones. It is lighter colored and fresher. It might be termed an augite porphyrite, although the feldspar might make it an augite-diorite porphyrite.

No. 29. This is a hard gray rock, with rather indistinct crystals of white feldspar. Under the microscope it appears to be badly decomposed, showing remnants of twined feldspar crystals, magnetite, and a dark constituent entirely decomposed. Might be termed a diorite porphyrite.

No. 30. This is a feldspar-quartz porphyry, showing large crystals of quartz, feldspar, and a bronze-colored mica in a fine ground-mass. Under the microscope the quartz appears much corroded, and the feldspars clouded. The ground-mass is made up of a fine-grained aggregate of quartz and feldspar.

No. 31. This rock contains hornblende, quartz, and plagioclase feldspar crystals in a granular ground-mass. In structure of components it lies between a granite and a porphyry and might be termed a granite porphyry.

No. 32. This is a rather fine-grained greenstone or diabase schist. It consists under the microscope of augite, pale green feldspar, probably labradorite, and iron ores. The constitutents are much altered.

No. 33. This is a quartz-feldspar porphyry. It contains crystals of twined feldspar (plagioclase), corroded quartz crystals, and a decomposed mineral possibly once hornblende. There may be some decomposed mica. These constitutents lie in a fine granular ground-mass.

H. W. FAIRBANKS, A.B.

In every mine accessible along the Central Lode, from the Pocahontas near Drytown on the north, to the Muldoon south of the Argonaut near Jackson, where ore-bodies are found in contact with or in slaty rocks, these slates are observed to be of the character described, and which the microscopic study of Mr. Fairbanks proves to be the result of alteration of tuffs, and not of massive diabase, as had been supposed by the writer.

The normal tuff is, however, massive, often fine-grained and containing crystals of augite, and difficult to distinguish from crystalline greenstone with the unaided eye; in this respect resembling the tuffs of Michigan, described by Mr. Williams, and those described by Captain Dutton as occurring in the Great Basin region of Utah.

The clay slates of the Mariposa beds are found in cross-cuts extending to the eastward and westward of the main fissures in these Amador mines. Usually the clay slates may be readily distinguished from the altered tuffs, but often the slaty tuffs graduate by insensible degrees into the clay slates, so that no line of demarkation is discernible.

It is rarely that the ore deposits are found in contact with the fine-grained clay slates, even for a short distance. In fact, the fissures, where passing through the clay slates are usually destitute of value in Amador County. This peculiar condition, however, appears to be local, as in Calaveras County the richest portion of the Gwin Mine is in a fissure cutting the black clay slates of the Mariposa beds, and in Mariposa County the Princeton Mine is wholly in the clay slates of the Mariposa beds.

In Amador County, however, it seems important to make the distinction, in view of the results obtained from veins in the clearly recognized clay slates and the pitted slates (altered tuffs). Although the mines of the old Plymouth Consolidated Company at Plymouth have not been accessible for many years, the dumps show a large amount of the tufaceous slate, and there is little doubt these slates accompanied the ore-bodies. Four miles to the northward, however, the Kretcher vein of the Bay State Company and the veins of the Rhetta Company adjoining it on the south, occur in the typical clay slates of the Mariposa beds, and in these mines are good-sized veins of banded quartz carrying payable values.

The Dolomitic Vein.—An important geological feature of the Central Gold Belt, and one which repeatedly appears from Mariposa to El Dorado County, is a great, dike-like vein of dolomitic mineral. This consists of carbonate of lime and carbonate of magnesia—a true dolomite—and in many places there is also found, in addition to the above minerals, carbonate of iron, forming ankerite.

This material occurs in great vein or dike-like masses, and is a prominent feature of the lode in Mariposa and Tuolumne Counties and the southern part of Calaveras County. It also appears near San Andreas,

and again near Jackson in Amador County, reappearing near Placerville in El Dorado County. Mariposite is nearly always present, often in large amount. Its beautiful green color led early prospectors to believe it was copper carbonate. The mariposite is not colored by copper, but by chromium.

The peculiar characteristics of the great dolomitic vein are no better shown anywhere along its length, perhaps, than at Coulterville and vicinity. Just below the village on Maxwell Creek, the great vein crosses that stream, which has cut a gap through it about 100 feet wide. On the south side of the creek is located the Louisa Mine, and immediately north of it is the Margaret, on the opposite side of the creek. Where the lode crosses the creek it has a width of 300 feet, and consists of an immense mass of ankerite, through which is disseminated the green, scaly mineral, mariposite. Large lens-shaped masses of quartz outcrop boldly from the ankerite, being somewhat harder than the latter. The lenses are irregularly distributed, but occur mostly along the hanging-wall and near the center of the vein. The large veins or lenses of quartz are separated by equally large or larger zones of the dolomitic mineral, which is interlaced in every direction by quartz veinlets and veins of varying size, making the entire mass a mineral zone or lode proper. One of the quartz lenses is nearly 20 feet in width, outcrops to a height of 25 feet, and is 300 feet long. A shaft sunk on the foot-wall side of it to a depth of 60 feet showed it to be thinning out; but there is no doubt that it would be found replaced in depth by another lens of a similar character.

South of this large cropping a small vein branches out into the hanging-wall diabase, striking northward and increasing in width until it disappears underneath Maxwell Creek. On the opposite side of the stream a large vein appears, which is apparently the northward continuation of the one referred to.

Through the center of the lode is a quartz vein 10 to 20 feet in width, and still west of it is another, but smaller vein. The entire western portion of the ankerite mass, constituting about one third of the whole width of the zone, is a perfect network of small quartz veins, stringers, and small bunches of quartz.

A prominent feature of interest is the union of two of the largest quartz lenses near the center of the lode by a third large vein, which crosses the intervening ankerite diagonally. The two large veins are about 120 feet apart. Beginning near Maxwell Creek, on one of the large outcrops referred to, a careful examination discovers a seam in the quartz, along which gold may be seen almost every foot of the way. This gold seam can be followed some distance in a southerly direction to where the diagonal branch above referred to leaves it. This latter also shows gold along a similar seam, leading to the other large quartz

lens parallel to the first, and here, again, is a gold seam which may be followed if care be taken. Outside of the gold thus occurring, none was observed elsewhere by the writer, though it was said that prospects could be obtained by crushing certain portions of the rock and carefully panning it.

Southward from the section above described, the several large veins converge toward a central point on the ridge, which rises higher and higher, terminating in an immense mass of quartz at its apex. Southward from this point the quartz is less prominent and the ankerite constitutes the major portion of the lode until another occurrence of quartz lenses is reached, which in each case, whether following the lode north or south, is much the same.

Gold sometimes occurs in the ankerite and mariposite, when seamed with quartz. A brecciated, crushed condition of this rock seems to favor the gold, or, at least, rock of this character contains more gold than that which is massive and solid. The entire mass is low-grade, and ankerite wholly free from quartz is practically free from gold in this mine.

The characteristics as above described are peculiar to the occurrence of the dolomitic vein wherever it appears. Often large masses of it are found crushed, sheared, and altered to talc schist or to a granular talcose mass, including many angular fragments of crystalline mineral. In the Rawhide Mine in Tuolumne County was found a notable exception to the usually observed condition. At one place in this mine the ankerite and mariposite were found phenomenally rich in gold.

As a matter of course, the description of the occurrence at Coulterville is not absolutely duplicated anywhere along the lode, but it is typical in its general features of the dolomitic vein throughout the length of the lode. In the Pacific Mine at Placerville, the talc schist resulting from the alteration of the dolomite contains 1 to 2 per cent of iron sulphide, but whether or not it is auriferous was not ascertained.

The mines of the Central Gold Belt, where not in the dolomitic vein, occur in black clay slates, in tufaceous black slates, and in amphibolite schist, and are described under their proper heading.

The East Lode.—The mines of the East Lode, which are found from 6 to 18 miles east of the Central Belt, occur in the slates of the Calaveras formation and in grano-diorite. Some of the most important of these mines are found in the latter formation, and a description of their general characteristics is of interest.

Granite areas in which gold-bearing veins occur are found in Mariposa County, near Hite's Cove; in Tuolumne County, near Groveland, near Columbia, and at Summersville and vicinity; in Calaveras County, at West Point and vicinity; in Amador, at Pioneer; in El Dorado, at several localities; and in Nevada County, at and near Grass Valley and Nevada City.

Veins in Granite.—In the several granite areas referred to occur a large number of veins, some of which appear entirely independent of all others, and in other instances are found systems of connected fissures, which were evidently produced by a common cause. These veins have definite characteristics, and the ores are noticeably similar throughout the entire granitic region referred to. They are usually easily distinguishable by their physical appearance from the ores occurring in other formations, whether in the same vicinity or from some distant point.

The strike and dip of these veins in granite are not at all uniform, in this respect differing greatly from the veins of the Central Belt, which almost universally strike west of north and dip easterly. In the granite areas the veins have no uniform strike, but are found from true east and west courses around to north, and at all angles between them. The dip is no more uniform than the strike. Whatever the direction of dip of a vein, it is usually not persistent at or near any particular angle, but varies from a low angle to nearly or quite perpendicular. Not infrequently, in depth a vein will dip in an opposite direction from that which it has at and near the surface. The veins occur along lines of fissuring. These fissures are found singly, in pairs, and in many places as zones of fracture of varying width, comprising several fissures having an approximate parallelism. These fissures, singly and in groups, are often planes of movement, as evidenced by slickensides and gouge seams. In many cases these zones of fracture are found to consist of crushed granitic material, greatly altered, and in some instances containing vein quartz in a granulated condition, indicating that a movement of the rock-masses has taken place subsequent to the deposition of the quartz. In certain more rare cases, this brecciated or granulated quartz has been cemented by a still more recent infiltration of silica. In these crushed zones the feldspars are thoroughly kaolinized; the bi-silicates are altered to chloritic mineral, and the whole mass is soft and, when wet, sometimes mushy, forming dangerous ground to mine. Often it is gold-bearing, though seldom rich.

In the same fissure plane or zone are found the concentrated mineral deposits forming the ore-bodies proper of the mines. In some places they lie at the side of these crushed, partially silicified zones, either in direct contact with them or separated by a strip or wedge of hard granite, but little altered. In other instances they are found as separate ore-shoots, connected with the previously described crushed zones only by a clay seam. Other masses of quartz occur in these fissures, which contain very little of either gold or sulphide mineral.

These veins are undoubtedly the result of substitution of silica, calcite, and other minerals for the original soluble constituents of the granite, having been conveyed to the point of deposition by mineral

solutions, probably derived from a deep-seated source. The most complete replacement has evidently occurred where the fissuring and crushing have been greatest. The vein quartz is found exhibiting every phase of condition from a partial alteration of the granitic mass, almost a normal granite (though the feldspars are always carious, and a small percentage of finely divided iron sulphide may usually be observed), through the various stages of transition, finally reaching the most complete alteration to crystalline quartz, sometimes heavily impregnated with the sulphides of iron, lead, copper, zinc, and silver, with gold and other minerals more rare. Calcite is a frequent accompaniment, both in the quartz and in the crushed zones of granite. The vein quartz occurs in a variety of conditions—as a vitreous, colorless, granular rock; a milk-white, semi-greasy kind; a bluish-black variety, usually vitreous; also in alternating bands of bluish and white rock, and as granulated quartz. All of these varieties are gold-bearing, and again all kinds are barren. All are associated with sulphide minerals, and all again occur with scarcely a trace of them. The banded varieties are usually of fair grade in gold, and the appearance of galena is often an index of value. Some of the zinc ores are also high-grade. The sulphide minerals contain from $50 to $1000 per ton in gold, and some are also correspondingly rich in silver, though the silver contents are usually relatively small. The sulphides are pyrite, marcasite, mispikel, chalcopyrite, galena, blende, and pyrrhotite. The latter is peculiarly characteristic of granite formations throughout California, particularly in the ore-bodies of larger size. Tellurides of gold occur sparingly in several localities. The ore-shoots vary greatly in width and length, though the veins sometimes have a width of 30 feet or more, as in the Black Oak Mine in Tuolumne County. Ordinarily, however, the shoots are less than 100 feet in length and average between 6 inches and 2 feet in width. Often the lenses have an average length of 20 feet, but succeed each other immediately, the ends often overlapping, thus forming practically a continuous shoot of considerable length.

Occasionally are found two veins approximately parallel and separated by 1 to 4 feet of granite in a more or less advanced condition of alteration, as is the case in the Good Hope Mine, near Perris in Riverside County. The branching tendency of the fissures is a pronounced characteristic. Usually one wall at least is well defined—generally the foot—the zone of fracture and crushing extending to various distances into the hanging-wall. Now and then a perfectly defined hanging-wall will be found, but progressing along this wall it is seen to diverge gradually from the plane of the foot and its influence as a bounding plane is lost, another slip or wall taking its place. This continues indefinitely until the identity of the entire vein is lost in the numerous branching cracks which extend into the granite. Often a well-defined vein several

feet in width will thus pinch out to the merest crack, in which is found no sign of clay or of movement, and it requires the most careful observation to follow it at all; but usually by persisting in the general direction of the course of the vein it may be found to reopen and new shoots of ore found. Sometimes, however, after drifting fruitlessly some distance, a cross-cut is advisable. In some instances these pinches are several hundred feet long and the ground very hard.

The formation of many short shoots of rich ore in portions of the fissure where the walls are several feet apart is an interesting feature. It is not uncommon to find a wedge of quartz forming on the foot-wall, which gradually widens to 1 or 2 feet when it leaves the foot-wall, crosses the fissured zone at a low angle, and joins the hanging-wall, where it thins out and is lost. Between the short shoot of ore thus formed and its parting from the foot-wall there may be found several stringers of quartz parallel with the foot, or the entire space may consist of a reticulated group of small veins and seams, while along the foot-wall a second wedge-shaped vein of quartz will appear, which will repeat the peculiarities of the shoot adjoining as described. The granite adjacent to the vein, and occurring as horses within it, is frequently gold-bearing to a considerable extent, sometimes in sufficient quantity to be visible to the naked eye.

It is the custom to sort out the granite as waste, but it should be done with caution, for it not infrequently pays to send the entire contents of the vein to mill, when in the pay shoot. The fact that several old dumps have been worked at a profit is evidence that early methods were careless in this regard. In some respects these mines are worked at a disadvantage, for it is easy to lose the vein where a pinch occurs, and it has led in numerous cases to the closing of what are probably good mines. What has been described as occurring along the vein horizontally is equally applicable to the fissure in depth, and a pinch in the shaft does not signify that the limit of the vein has been reached any more than it does when occurring in the face of a drift.

These disadvantages are greatly offset, however, by the high grade of ore, which is uniformly much higher grade than that in larger veins in other formations. Often the ores from the veins in granite may be shipped to distant smelters with profit after rough sorting.

Dikes are of frequent occurrence throughout the granite area in the neighborhood of the mineral belt. They are of various types, but the most common are granitic dikes of coarse crystallization and dark green diorites of fine grain, extremely tough and hard. The former are characterized by the occurrence of masses and crystals of albite, tourmaline, and biotite. The peculiar, interwoven, grate-like structure of quartz and feldspar, known as graphic granite, is of frequent occurrence in these dikes. These granitic intrusions are usually older than the veins,

though there are exceptions. The diorite dikes, however, are generally younger and cut the veins. The dikes, as a rule, cross the line of strike of the veins, though not always. Whether or not these dikes have any important influence on ore deposition is a question.

In some instances ore-shoots are found lying with the granitic dikes, the downward pitch of the ore-body being coincident with the dip of the dike. The influx of large quantities of water is a usual accompaniment of the development of these veins. It often comes with a rush at unexpected times. A mine may be developed to considerable depth and have encountered but little water, when without warning a blast will break into what is called by the miners a reservoir or pocket, though usually, in fact, a system of fissures filled with water derived from the surface. The deeper the point in the mine at which these water crevices are struck, the greater the force of the water. Often the lower levels are completely flooded, and weeks are required to pump out the water, but in time the reservoir is exhausted, and things resume their usual condition. Another water-rush may not occur in many months, and again in some places they have been found in quick succession. In one instance a water crevice was broken into in the Black Oak Mine in Tuolumne County at a depth of 600 feet. With considerable difficulty a bulkhead was constructed, and the pressure gauge indicated at one time a standing pressure of 180 pounds to the square inch, indicating that the height of this reservoir was not less than 400 feet. The flow being controlled by means of a valve, the pumps in time removed the water and a normal condition was again reached. After several months the bulkhead was torn out and a round of holes was drilled in the face and discharged, upon which the water again rushed into the mine workings in as great volume as before. The probability is that in some manner the vent to the reservoir had become clogged and the flow of water stopped. The force of the blast removed the obstruction, and the water again poured into the mine workings, but it finally was drained to a considerable extent. This shows the necessity for abundant capacity to handle water. Some claim that large flows of water are an indication of valuable ore deposits, but there is really no apparent relation between ore deposits and large flows of water. The ore was deposited by ascending currents, and the water found in mines is always found coming down from the direction of the surface. Sometimes water may be seen bubbling up from the lowest levels of the mine as though from an ascending current, but a case of this kind is due to hydrostatic pressure, the water flowing in coming from some point higher, through a series of connected cracks or fissures.

A peculiarity of these veins in granite near the surface may often be observed in the occurrence of open cracks traversing the vein in a horizontal direction, reaching from wall to wall, and dividing the vein into

blocks by a series of floors, as it were, at quite regular intervals of a foot or thereabouts, depending somewhat on the width of the vein. The blocks are separated by 1 to 4 inches of space, in which have accumulated clay and grit, quartz crystals, iron oxide, and other secondary products and gold. The amount of gold is largely in excess of the amount found in an equal weight of quartz of the vein itself in many cases. This peculiar occurrence is undoubtedly due to a sort of molecular expansion of the granitic mass, chiefly due to the alteration of the feldspars, and in a less degree possibly to the change which has taken place in the other constituents of the granite caused by surface decay and meteoric agencies generally. It is an interesting fact, and affords food for study and investigation.

The occurrence of gold in the silt-like material lying on these floors may be due partly to the quartz itself, but more probably comes from the oxidized sulphides, and also in part perhaps by infiltration from the selvages of the vein, if not from the granite itself, which may have become gold-bearing by impregnation from the fissure. Attrition, due to movement, may also have been partly responsible for the occurrence of this gold. When the oxidized zone is passed and the granite becomes normal, these floors no longer appear.

In many places the quartz is perfectly free from both walls, and again but one wall is free, the opposite side being frozen. In an equal number of cases the vein is frozen on both walls. These variations are not constant, for a vein may be free at one place and frozen in another. These changing conditions may be considered as indicating something of the relation of the original fissure to the ore deposit. Where both walls are free, it is not unlikely that the ore is filling the space bounded between two fissures. Where one wall is free the mineralization has progressed along one side of the fissure plane only; and where both walls are frozen, it would seem to indicate that ore deposition progressed outwardly from a single crack, or possibly, in the case of a large ore-body, the mineralization has impregnated the walls beyond the limiting planes of the fissured zone, to an extent sufficient to constitute ore, and has stopped only when the mineral solutions were unable to penetrate farther from the fissure plane itself.

METHODS OF MINING.

The mining methods in vogue on the Central Lode of California are not, in the opinion of the writer, those calculated to produce the best results, when viewed from the standpoint of economy. They are, with few exceptions, the methods of thirty, of forty, and of fifty years ago, and some of the practices are so primitive in their nature as to savor of past centuries rather than of decades.

A policy which obtains throughout the mining districts of California is that of demanding prompt returns from ore development, which is of course very desirable, but which in many cases works ultimately to the disadvantage of the owner, and the manager or superintendent is so completely handicapped that he is unable to make substantial headway. There are certain districts where this demand for "immediate returns" does not act so disadvantageously, but in the mines of the Central Lode it is undoubtedly a short-sighted policy. The reason for this will become apparent when it is understood that with few exceptions the ground is heavy—often swelling and crushing the heaviest timbers. The usual practice is to drive a cross-cut or drift from a station at the shaft to the vein. This may or may not at once encounter ore; if not, a drift is driven along the fissure, which must be timbered in the most substantial manner. These drifts are usually not less than 7 feet high, 4 to 5 feet wide at the top, and 7 to 8 feet at the bottom. These dimensions are all inside the timbers. It usually makes little difference whether the cutting is in ore or not, the ground is generally heavy. The fissures are often from 10 to 40 feet wide, and the miners (of Amador County particularly) are well acquainted with the danger, difficulty, and expense attending this kind of mining. As soon as pay rock is encountered it is hoisted and sent to the mill, and the drift continues, while overhand stopes are started and development proceeds. It may be several hundred feet to the limit of the property, and is often over 1000 feet, and this heavy swelling—sometimes running—ground must be kept open until the entire level has been explored and the ore to the level above all extracted and sent to the surface. An idea of the character of some of this ground may be gained from the statement that in a certain instance a drift of usual size being driven a distance of 200 feet, at the rate of 5 feet or more daily, under contract, could not be completed before it became necessary to return to that portion first driven for the purpose of retimbering. The timbers employed in holding ground of this character are usually 20 to 30 inches in diameter, and it is no uncommon thing to see these immense logs, a few weeks after being put in place, split, crushed, and broken as though they were incapable of offering any resistance to this all but irresistible force.

The advisability of cutting the main gangways in the hard rock of the walls, either foot or hanging, and reaching the vein by a system of cross-cuts, is advised. This has not, as yet, at this writing, been attempted, but its feasibility and desirability can readily be appreciated when the character of the main fissure, as above explained, is understood.

These main gangways, being driven in, say the foot-wall, should have cross-cuts extending at right angles to the direction of the main gangway. These should be disposed at stated intervals for the purpose of

prospecting the fissure and to render accessible the ore discovered. In slate, the main gangways should be at a distance of 40 to 60 feet from the vein—where in greenstone, they may be driven nearer the vein. The cross-cuts should be driven at stated intervals, a greater or less distance apart according to the character of the ground adjacent to the vein. When the ground is very bad, the cross-cuts should be closer, and when less so, at longer intervals. In most cases, if driven at intervals of 240 feet, the distance will be found convenient. Raises should always be put through, connecting with the level above, before stoping is commenced. Very often this important matter is neglected, owing, as previously stated, to a desire to realize a profit on the ore as quickly as possible. These raises should be put in about 60 feet apart; this, beginning 30 feet from the point where the cross-cut reaches the vein, will admit of four raises within the 240-foot section suggested, the vein being worked 30 feet each side of the raise.

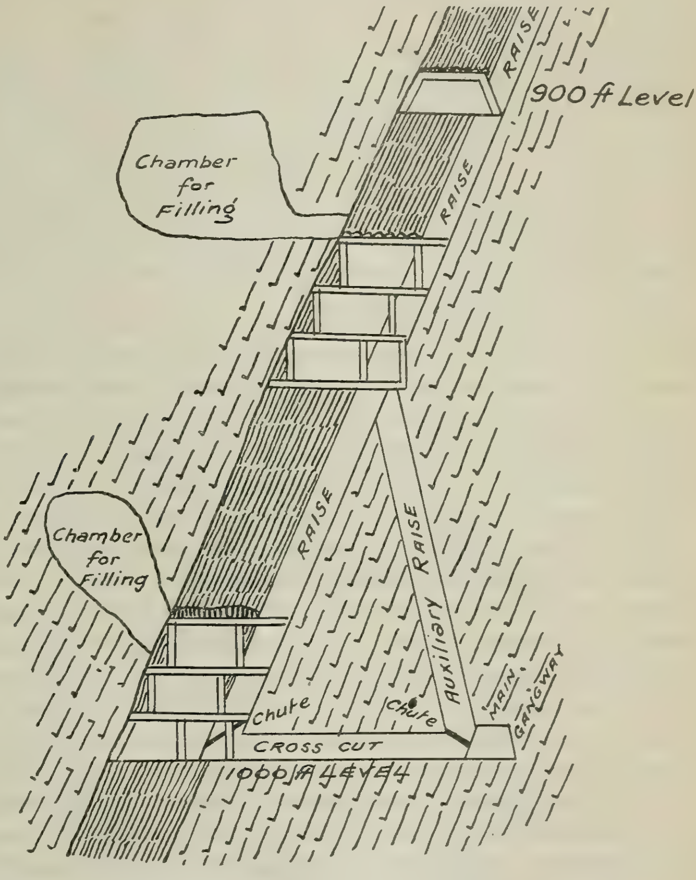
When putting through raises, it is really an economical plan to sink a winze from the level above to meet the raise. By this means ventilation will be more quickly obtained, and the additional work which men can accomplish will soon pay for the increased cost of sinking the winze. Men will not and cannot perform the best work most expeditiously in a foul atmosphere, though this fact seems to be lost sight of by many mine-owners.

In addition to the great disadvantage of foul air, when the raises are not put through, the heavy timbers must be hoisted through the raise into the stopes by means of block and tackle at great expense of time. If the raise were through, the cost of handling these great timbers would be very materially reduced by lowering them through the raise from the level above to the floor of the stope where they are to be placed in position.

With the lateral drifts and cross-cuts completed, and drifts driven on the vein, with raises through to the next level above, the work of stoping can be carried on at as many points as may be desired, and in a few weeks, or months at most, the greater portion of the excavation made on the vein, where not filled, will collapse and be closed up forever. This works no harm or inconvenience, as the main lateral drift remains open.

When operating in this manner, filling for the stopes may be taken from the hanging-wall by driving an inclined raise into it and opening out a chamber. The rock broken in these chambers will pass by gravity down into the stopes beneath and fill them, little or no shoveling being necessary. This method of mining and filling, when properly carried out, will prove more safe and far less expensive than some of the methods heretofore employed in California mines. In some mines, if stoping be expeditiously prosecuted in the manner above suggested, no filling will be required, the timbers affording all the support necessary, but in most

cases filling of the stopes is advised. Where the hanging-wall country adjacent to the vein has a tendency to cave, it may be that the inclined upraise for the purpose of obtaining filling for the stopes may be inexpedient. In that case, a horizontal cross-cut may be driven to the solid ground of the hanging, that portion nearest the vein being securely timbered. The filling must then be distributed by means of wheelbarrows.



Method of Working Veins in Swelling Ground,
FIG. 2.

These filling chambers may be worked with hand or power drills, large or small, as seems desirable. One of the greatest items of mining expense, as now practiced, is that of constantly relieving swelling or running ground, and retimbering. When the ore-shoot is attacked in sections by cross-cuts from the lateral drift, any particular section need remain open only a few months at most, instead of two, three, or more years, as now.

Another advantage may be derived by driving an intermediate level midway between the main levels, if the ground is particularly bad, and connecting with the cross-cut or gangway beneath by a raise. In this manner the floor of the lower main level need only be maintained about half the time that would be necessary if all ore were sent down to the main level through a mill-hole extending upward 100 feet more or less, and connecting two main levels. This plan would, of necessity, require that a raise be cut through solid rock from the vicinity of the main gangway to the foot-wall of the vein, reaching it about midway between two levels. Each of these raises would have an approximate height of 45 to 60 feet, and would cost, perhaps, when timbered, $500; but the expense of keeping open the level in the vein would soon offset this expense if the ground were very bad. As a matter of course, the superintendent must determine when an intermediate level and auxiliary raise are justifiable. His experience with the ground in the fissure will dictate whether the plan suggested is advisable or not. The sketch (Fig. 2) on page 29 illustrates the idea.

Timbering.—The timbers employed in the mines of the Central Lode are uniformly large—18 to 30 inches in diameter—and the method of framing and placing them varies somewhat, but is usually, in the larger stopes, some modification of the system known throughout the world as the Nevada square-set. The placing of these timbers is accomplished often under great disadvantage, and, in some instances, with considerable evident danger. The men selected for this work usually represent the finest type of physical manhood, for no others could accomplish the arduous task expeditiously. As to the relative merits of the respective methods of framing these heavy timbers, it seems only necessary to say that those systems involving the least framing with ax and adz underground, and consequent smaller loss of time in placing timbers in position, are the methods best adapted to regular practice.

In some mines an objection is raised to the employment of sills on the main floor of a level, for the reason that the sills rot before the stopes can be carried through from any level to the next above. In most cases there is no excuse for this. A reprehensible practice, which is found almost universal in these mines, is that of attempting to carry up stopes of too large a superficial area, and this practice is responsible for some disastrous caves which have occurred in various mines. A stope of smaller superficial area can generally be carried from one level to the next above more quickly and safely than a large one, and in most cases, even by the present "old-fashioned" methods of mining, a stope of small sectional area may be carried through in a few months—long before the sills become weakened by reason of decay. If the development of the mine were carried on well in advance of the extraction of the ore, it would not be found necessary to open these large stopes, as a num-

ber of smaller stopes would supply the same amount of ore daily as is usually drawn from one, two, or three large stopes, and it would be found that ultimately the cost would be materially less, as in most cases there would be no loss of ore, no disastrous caves, and work could be accomplished more expeditiously and more cheaply.

Filling.—There are few veins on the Central Lode where, by present mining methods, filling is not absolutely necessary, though by the adoption of the lateral foot-wall gangway system heretofore suggested, in some of the smaller mines, filling might to some extent be dispensed with, the walls being allowed to collapse after removing the ore. Material for filling is usually obtained from cross-cuts and drifts driven in prospecting, and from chambers cut in the walls of the veins—generally the hanging-wall. There are few veins on the lode so small as to make enough waste in stoping to fill the excavation. Ordinarily, all the rock removed from the pay-shoot goes to the mill, and filling must be obtained elsewhere. In some of the larger mines, where the veins are of great size—40 to 100 feet or more in width—it is not uncommon to find the entire vein removed for a distance along its strike equal to and often much greater than its width, the entire area overhead resting upon the props reaching from the topmost set of timbers to the roof. There may be three, four, or more floors in place, and the stope may be found filled from the sill floor to within a floor or two from the top; but it is clearly evident that in a stope of the size indicated, this filling can afford but little if any support to the hanging-wall, and none at all to the back of the stope. Failure to recognize this fact has resulted disastrously in more than one mine. The filling must be placed in such manner as to support the back of the stope over as large an area as possible, and a portion of this filling at least must be placed by hand, for it is clearly evident that should any subsidence occur in a stope approximating 100 feet square, timbers cannot be depended on to support the great weight. In a stope having a width and length of 100 feet and carried up four floors in height, there would remain between the top set and the floor of the level next above (65 feet) not less than 50,000 tons of ore. Should this become "dead weight," each post of the sets in place would have to sustain a load of several hundred tons of ore in addition to the weight coming from ore and filling in levels above, and to this must be added the greater pressure coming from the direction of the hanging-wall. This weight, or pressure, will vary greatly in different mines, depending upon the character of the ground, the condition of the walls, and to no small extent upon the angle of dip of the vein. Were the enormous weight of this great shifting mass of rock equally distributed, there would be less probability of a cave; but often, the weight being transferred from point to point, owing to the mobility of the ground, the pressure upon some given point becomes greater than the timbers can

sustain, and a single line of sets once forced out of position renders the remaining sets less secure than before, and general collapse results; and most miners are familiar with the dangers and extraordinary expense incident to the recovery of a caved stope and the extraction of the shattered masses of ore from the zone above the cave. In veins having vertical walls the danger of caves is much lessened, but the mines of the California Gold Belt dip at all angles ranging between 30 and 85 degrees, the greater number being between 45 and 70 degrees, below the plane of the horizon. This being the case, the pressure upon timber sets is exerted diagonally and not directly downward upon the posts of the sets. Naturally this renders the square, or rectangular, sets less capable of sustaining the weight and pressure. In some mines diagonal braces are set in to take this hanging-wall pressure more directly, but timber will not hold it.

In consideration of the above facts, the absolute necessity of filling becomes apparent, and the necessary preparations to this end should always be promptly made in order that the filling of the stopes be not too long delayed. Filling must be carried on contemporaneously with ore extraction; and in stoping, the excavations should be carried upward in sections of relatively small superficial area, the filling being packed as close to the back of the stope as possible. Where the veins do not greatly exceed 15 feet in width, the conditions are essentially changed, as in such cases the stopes may be timbered with stulls set slightly above a right angle to the dip of the walls. Most mines, where the walls are sufficiently firm, are timbered in this manner when the distance between walls admits of it. The conditions are so variable in these different mines, and often in different parts of the same mine, that the methods of timbering embrace almost every phase known in practice. The various methods of timbering employed in California mines and elsewhere were described and illustrated by the writer in Bulletin No. 2 of the California State Mining Bureau, February, 1896. See also method of stoping and filling at Eagle-Shawmut Mine, Tuolumne County, in this bulletin.

Drainage.—A very important factor in the economy of mining is the water encountered in the underground workings, and an ever-present question is the most inexpensive method of removing this incoming water from the mine. It is accomplished in three ways:—by natural drainage through tunnels; by means of pumps, or by bailing. This subject has been exhaustively treated in Bulletin No. 9 of the State Mining Bureau, by Hans C. Behr, M.E., and it is unnecessary to more than refer to it here. On the Central Gold Belt, and in fact throughout California, the large majority of mines bail water from sumps at the bottom of the shafts, or from tanks situated at various levels, where water descending from the surface and upper levels is caught.

Where the inflow of water is large, and the shafts are poorly equipped with hoisting machinery, with crooked, rough tracks or skids, the problem of bailing water, hoisting ore and waste, and carrying on development work—particularly that of sinking in the shaft—becomes a serious one, and sometimes it necessitates shutting down all work in the mine except that of sinking. Where this very undesirable combination of conditions is found, steam pumps are the most satisfactory, and it may be said that there is a growing tendency to the more extensive employment of steam pumps in mines of the Pacific Coast. In many cases steam pumps are found replacing the Cornish pumps.

In this connection, the following contribution will be of interest to mine managers generally. It was written by request for this bulletin by Mr. J. Renshaw, one of the foremost hydraulic engineers of the United States, and who has had a very extensive experience in mine-pumping operations where they were conducted on a large scale:

SOME OBSERVATIONS AS TO THE RELATIVE ADVANTAGES OF CORNISH AND DIRECT-ACTING DUPLEX PUMPS FOR PERMANENT MINE PUMPING.

By Mr. J. Renshaw, of Denver, Colorado.

(Written by request for this Bulletin.)

The following comparisons of the relative advantages of the higher grades of direct-acting, duplex steam pumps as compared with the old and well-tried Cornish system, refer to permanent pumping plants for mines in which the water is below the temperature of about 70° or 75° Fahr. When the water is above that temperature, it is evident that the exhaust steam from the direct-acting steam pumps cannot be advantageously disposed of, and either the Cornish pump, or some other plan in which the motive power is located at the surface, must be used.

Up to 1878 some one of the various modifications of the Cornish pump was exclusively used both in Europe and in this country. In that year, a simple cylinder, non-condensing, single-plunger pump at the Ontario Mine, Utah, with 12-inch plungers, 24-inch stroke, and 500 feet vertical lift, was altered into a compound, condensing pump by the addition of an expansion cylinder and a spool-shaped bushing put in the original cylinder, the space between the original bore and the outside of the bushing forming a steam jacket. This pump was, we believe, the first attempt toward a higher grade direct-acting steam pump located in lower workings for permanent mine pumping. It was thoroughly tested, first by the writer and then by the designer of a Cornish pump which had been selected by the writer to be put in, should the other not prove economical. It met with strong opposition, mainly from the builders of the Cornish pumps, both in California and the East, and with much skepticism of Eastern mine operators, principally, we think, with the belief that steam could not be conducted in pipes a long distance without a ruinous loss by condensation, and this idea held among many not familiar with the results of the compound, direct-acting, condensing steam pumps that had been put in, until 1884 and 1886, when they were put in a mine at Leadville and in one in Ishpeming, Mich., since which time very few Cornish pumps have been built in this country.

In 1882 or 1883, a Cornish pump was built for the Ontario Mine, which is no doubt the best example of that style of pump built, at least in this country. The writer had no opportunity to test it, but the manager of the mine said that he thought it saved a little in steam over the crude, direct-acting, condensing steam pumps that had been installed in that mine. When asked if he was sure as to any saving in steam, he replied that he was not, and later advised a mine operator in Leadville to put in the direct-acting, duplex condensing pump as against the Cornish pump, as the difference in cost more than balanced the possible saving in steam.

We know of no publicly reported experiments having been made to determine the amount of condensation in steam pipes until a series was made by the New England Board of Underwriters, and reported in the transactions of the American Society of Mechanical Engineers. The result then had, on pipes covered with one inch of hair felt and that by a thickness of burlaps, coincided almost exactly with what we had determined at the Ontario Mine with the same thickness of hair felt covered with 10-ounce canvas. At the Wolftone Mine at Leadville, the condensation in 585 feet of 4-inch wrought-iron pipe, covered with $\frac{1}{16}$ inch of asbestos paper, 1 inch of hair felt, and this covered with painted 10-ounce canvas, was 57.75 cubic inches per minute, or 8.396 cubic inches per minute for each hundred square feet of external pipe surface.

Judging by past experience, there is little difference in "duty" between the best examples of Cornish pumps and the best examples of direct-acting, compound condensing pumps, each, for say 1000 gallons per minute lifted 1000 feet vertically.

With triple-expansion, direct-acting, condensing pumps with the initial steam pressure at the pump at 140 pounds, and the pump running at say 125 feet piston speed, the comparison would undoubtedly be much in favor of it over the Cornish pump.

There are, however, other very important considerations to the mine operator as to the relative advantages of the two systems of pumping, besides a little difference in the steam economy. On a basis of 1000 gallons lifted 1000 feet per minute, the installed cost of the direct-acting pump will not reach 10 per cent of that for the Cornish pump. In most cases the working-out of the mine beneath the foundations of the Cornish pump engine will, by settlement, throw it out of line, it not being a self-contained machine like the direct-acting pump. So, also, with the "pit-work."

Another very important consideration is the expansibility—if we may so call it—of the two systems. When the size of a Cornish pump is to be determined, a large margin for increase of water through greater depth or side workings has to be allowed for, and what this margin is to be is difficult to determine. As a rule, but one Cornish pump can be installed in the one-pump compartment of the shaft, and it cannot be replaced by another without allowing the shaft to be flooded; and it is a question if it could be taken out as fast as the water would rise. This would depend upon the amount of ground worked out. Frequently there is allowed a greater margin for increase of water than afterwards proves necessary, either from the ore-body giving out, or less water being encountered than expected. The interest on investment, and wear and tear of a larger machine than necessary, are important considerations. Or, it may be years before the full capacity of the pump is called for. On the other hand, if too small a pump is put in, a new shaft has to be put down in which to install another and larger pump. Thus, the size of the pump has to be determined once for all.

Not so, however, with the direct-acting pump. They need only to be bought as depth is attained or increase of size becomes necessary. If the pump proves too small, a larger one may be installed on the pump station and the smaller one moved down to a lower level where less ground has been opened, and so on, making pump stations every 500 or 1000 feet. If the column pipe for the first pump put in is not of sufficient size for the larger pump, there is generally room enough to put in a larger one, and the smaller pipe then used below for the small pump. The expenditure for pumps may thus be by increments as needed.

As we have said, pump-shaft compartments are seldom large enough to install but one Cornish pump line, and "the eggs are all in one basket"; whereas with direct-acting pumps, two may be installed in the one station, both connected to one column pipe or each with its own, and in case of necessary repairs, one may be stopped and the other started. It is very comfortable for the mine operator to feel thus secure.

If there are two or more compartments to the shaft, one of which is for pump, piping, and ladders, that compartment should be well bratticed from the adjoining hoisting compartment. The heat radiated from even the well-covered steam pipe tends to make that compartment an "uptake" and the hoisting compartment a "downtake," and thus fairly good ventilation is to be had in the pump station or level.

We need hardly say that it is important to keep pipes and their bearers snugly to the sides of the shaft, so that there will be left a clear run for the rising of warm or foul air.

When, through the decomposition of pyrites or other minerals, the water is too hot for the condensation of steam below, then either compressed air may be substituted for steam, electric, or rope-driven power pumps, or the Cornish pump must be used. With

the utilization of mountain streams as a source of power, and either electricity or compressed air to transmit it, comes a new feature in mine pumping which will be more and more used, as in most of the metal-mining locations the cost of fuel is a "burning" question. The transmission of power to the station pump by electricity would present a simple solution of the difficulty were it not that the speed of the pump has to be varied, either because of increase of water by ground opened, or by the seasons affecting the surface water. We think this difficulty can be overcome without uselessly expending power.

The above is given as a summary of the relative advantages of the two systems of mine pumping, for a part of which we have to rely upon memory, but we are substantially correct.

The Diamond Drill.—In a number of mines of the Central Lode the efficiency and great desirability of the diamond drill as a prospecting device has been repeatedly demonstrated. It has been used with good judgment and excellent results at the mines of the Wildman Company at Sutter Creek, and also at the Baliol Mine near Sutter Creek, Amador County; in the Lightner Mine, Angels, Calaveras County, and elsewhere; and there seems to be a more general disposition to employ this machine for the purpose indicated, as by its means ore-shoots may be located at a distance from the main mine workings, either in the hanging or foot wall, at a minimum of cost. Not only is the proximity or the absence of ore demonstrated, but the character of the barren rock through which workings must be driven in order to reach such deposits is also ascertained, and the cost of development thus approximately determined. The diamond drill may also be employed in locating old workings, making connections for ventilation, and even in draining old flooded workings. Its use cannot be too highly commended in a region where there are broad zones in which occur ore-shoots scattered at irregular intervals, and this feature is particularly characteristic of large portions of the Central Gold Belt. The diamond drill may also be used to advantage in both the gold and copper mines of the West Lode.

THE COST OF MINING.

Another consideration is the cost of mining. This is something which can never arbitrarily be determined until the character of the mine has been demonstrated. The width and length of the ore-shoot must be known, and the character of the walls ascertained. The probable quantity of water which will have to be handled is always problematical, and, as a matter of course, the character of the walls and vein material itself will determine the method and expense of timbering. It is not uncommon to hear it said that in California mining and milling can be accomplished, under favorable conditions, for less than $1 per ton, but these conditions so rarely obtain, even in California, as to scarcely be worth mentioning, for they by no means constitute or illustrate the typical features of California mining. There are mines in slaty rocks not particularly hard, where the veins are 3 to 7 feet in

width, which, being worked through tunnels and having free water power, are operated at a very low cost, but even this class of mines does not represent the majority—indeed, such constitute a very small minority.

In the greater number of mines in this State operations are conducted through shafts, which necessarily increase the expense of mining. In the Central Gold Belt the mines vary so greatly in size, depth, character of ore and wall-rocks, and quantity of incoming water, that a statement of cost would convey but little information, and comparison would be valueless unless accompanied by a complete knowledge of existing conditions and an itemized cost-sheet. At a number of larger mines elaborate cost-sheets are kept, and to a number of these the writer has been given the freest access. The cost of mining in the larger mines, under ordinary conditions, may be fairly represented by the cost-sheet of the Wildman Company at Sutter Creek, which has been kindly furnished by the superintendent, Mr. John Ross, Jr.

DETAILED AVERAGE COST OF MINING ONE TON OF ORE

For the Years 1896, 1897, 1898, at the Mahoney Mine of the Wildman Company.

	Total Cost for 134,886 Tons.	Cost per Ton.
	Dollars.	*Cents.*
Timbers	24,499 18	18.163
Spiling	4,913 05	3.642
Lumber	1,017 57	.755
Charcoal	1,242 01	.92
Candles	1,840 59	1.365
Powder	4,386 75	3.252
Fuse	780 16	.578
Caps	186 05	.138
Water	7,538 00	5.589
Freight	1,338 42	.992
Iron	1,224 24	.908
Steel and steel rails	1,417 27	1.05
Hardware	3,139 48	2.328
Oil	775 37	.575
Grease and tar	117 27	.087
Coal	229 57	.170
Miscellaneous	3,241 69	2.403
Power-drill machinery	2,346 90	1.740
Surveying	667 50	.495
Cement	15 00	.011
Insurance	103 77	.077
Taxes	737 63	.547
Wire rope	636 28	.472
Office supplies	97 67	.072
Superintendence and labor	160,003 58	118.621
	$222,495 00	164.950

JOHN ROSS, JR., Superintendent.

DETAILED AVERAGE COST OF MILLING ONE TON OF ORE

For the Years 1896, 1897, 1898, at the Mahoney Mill of the Wildman Company.

	Total Cost for 134,901 Tons.	Cost per Ton.
	Dollars.	*Cents.*
Shoes	2,310 00	1.712
Dies	2,078 63	1.541
Screens	441 97	.328
Quicksilver	870 14	.645
Hardware	1,199 05	.889
Water for power	10,699 60	7.931
Freight	1,064 00	.789
Cyanide potassium	162 00	.120
Wood	220 88	.164
Charcoal, iron, and steel	97 74	.073
Oil	63 95	.047
Grease	23 13	.017
Lumber	67 34	.050
Miscellaneous and coal	1,529 46	1.134
Timbers	17 95	.013
Assay supplies	516 59	.382
Office supplies	275 73	.204
Expressage, bullion	391 16	.290
Hauling and loading sulphurets	2,354 65	1.746
Silver-plating plates	281 50	.208
Insurance	423 14	.314
Taxes	701 11	.520
Plates	86 49	.064
Superintendence and labor	16,791 58	12.447
	$42,667 79	31.628

The above cost includes all repairs and equipment.

JOHN ROSS, JR., Superintendent.

Following is the cost-sheet of the Gwin Mine, Calaveras County, for the month of July, 1900, which is kindly furnished by Mr. J. J. Crawford, secretary of the company:

DETAILED COST OF MINING, MILLING, AND SULPHURETS AT THE GWIN MINE FOR THE MONTH OF JULY, 1900.

	MINING And Transporting to Mill 7,965 Tons.	MILLING 8,000 Tons.	SULPHURETS Concentration, Transportation and Reduction Charges on 108.545 Tons.
	Cost per Ton.	Cost per Ton.	Cost per Ton.
	$ cts.	cts.	$ cts.
San Francisco office—salaries, directors' fees, and expenses	.0082	.0084	------
Management	.0314	.0313	------
Mine office—salaries and expenses	.0129	.0075	------
Labor	1.3886	.0653	3.418
Water	.0650	.0875	.746
Electric light	.0013	.0022	.051
Timbers	.2754	------	------
Lagging	.0692	------	------
Wedges	.0103	------	------
Lumber	.0050	.0031	------
Powder	.0470	------	------
Fuse	.0080	------	------
Caps	.0020	------	------
Candles	.0335	------	------
Drill steel	.0085	------	------
Iron and steel	.0014	.0013	------
Tools and implements	.0055	------	------
Hardware	.0201	.0005	------
Charcoal	------	.0003	------
Oils and lubricants	.0035	.0017	------
Shoes and dies	------	.0600	------
Screens	------	.0007	------
Chemicals	------	.0002	------
Average loss of quicksilver of four years	------	.0070	------
Miscellaneous supplies	------	.0020	.275
Surveying	.0072	------	------
*Assaying apportioned	.0008	.0034	.212
*Blacksmith shop apportioned	.0341	.0053	------
*Pumps and repairs apportioned	.0301	------	------
*Power drills and repairs apportioned	.0017	------	------
Legal expense	.0025	.0006	------
*Equipment and construction apportioned	.0413	.0665	------
§Development apportioned	.0045	------	------
Taxes apportioned	.0370	.0081	------
Stable and animals apportioned	.0082	.0006	------
Compressor—labor and supplies	.0272	------	------
*Compressor apportioned	.0210	------	------
*Telephone line apportioned	.0012	.0004	------
*General improvements apportioned	.0100	.0038	------
Hauling sulphurets and back freight on sacks	------	------	2.203
Reduction charges and railroad freight on sulphurets	------	------	9.491
Total cost per ton	$2.2236	$0.3677	$16.396
For purpose of comparison, following items may be transferred from "Sulphurets" to "Milling" column:			
Labor	------	.0464	------
Water	------	.0100	------
Electric light	------	.0007	------
Miscellaneous supplies	------	.0037	------
Assaying	------	.0028	------
Total	------	$0.4313	$11.694

*Because of the deterioration of the machinery, etc., represented by these accounts, one per cent per month of their cost and repairs is inserted in this report.

§The development is apportioned according to the estimated life of that part of the mine affected by it.

At the Kennedy Mine, Jackson, Amador County, it may be stated without particular reference to detail, that the cost of mining, milling, and all development work, including the new vertical shaft and expense of conducting chlorination works, is about $5 per ton. The details of the Kennedy cost-sheet are not available for publication, as the company does not carry their cost-sheet out in all its minutia, being satisfied with more general statements of cost and profit, but it may be stated that the great apparent discrepancy as compared with that of the Wildman Company's sheet is due to the extremely unlike conditions obtaining in these two mines, which are not more than two miles apart. The Kennedy vein is much smaller than the great ore-shoots at the Wildman, but in the former they are seldom without heavy swelling ground, which, under the system of mining carried on for years at the Kennedy and other similar mines, requires constant relief and frequent retimbering. This comparison is made merely for the purpose of showing that comparisons of cost without a complete knowledge of the conditions affecting such cost, are practically meaningless, and are unjust to the mine managers who are willing to furnish such figures.

It should be remembered in the case of the Wildman Company's sheet that it includes the years 1896–97–98, but does not include the years 1899–1900. Within the past two years there has been a very material advance in the cost of many mining supplies and in mining machinery. The mine cost-sheet would be affected particularly in the items of iron, steel, steel rails, hardware, power-drill machinery, wire ropes, etc., and the mill sheet would show a probable increase in cost of shoes, dies, screens, quicksilver, hardware, iron, and steel. This increase in cost of the items enumerated would raise the cost of both mining and milling, and as a matter of course, would affect all other mines in proportion to the magnitude of their operations. At those mines treating the largest quantity of ore per stamp the milling cost would be lowest, and at those mines hoisting the largest tonnage of ore to the number of men employed the mining cost would be lowest. Ordinarily, in the larger mines, the cost of timbering ranges from 30 cents to 50 cents per ton of ore extracted.

MINING MACHINERY.

There is found in the Gold Belt a great diversity of mining machinery, from the crude windlass to magnificent plants costing many thousands of dollars. When it is determined to purchase a hoisting plant, it is always advisable to select such machinery as the conditions under which it is to work, and the object desired to be accomplished, shall justify. When it is the intention to sink a shaft to great depth, it is

the best policy to purchase light machinery at first, and at the depth of a few hundred feet, when necessary, to exchange this for heavier machinery, but not heavier than seems absolutely necessary to accomplish the work in hand. Very heavy and expensive hoisting gear is not advisable for shaft-sinking, nor before the mine has been developed to a stage indicating the necessity of such a plant for the purpose of hoisting large quantities of rock within a limited time. For instance, it would scarcely be considered wise to equip a shaft through which it is expected to raise 400 tons of ore daily, with machinery capable of handling ten times that amount. Heavy and expensive machinery is only justifiable when there is sufficient work for it to perform. There are, usually, at least two active periods in the life of a mine, which are distinctly separate. These are, first, the prospecting period; and second, the productive operating period; though many mines never pass the first stage.

Among the large new enterprises in the Gold Belt, the operations of the Mariposa Commercial and Mining Company, on the Mariposa Estate, are worthy of more than passing notice. These people, with probably the largest available capital for mining operations in the State, are prospecting five mines on their property. Everything is being done in a thorough, workmanlike manner, at the lowest possible cost, without the exercise of parsimonious economy. The machinery in use is first class and exactly suited to the work for which it is being used; that is, prospecting. When the limit of utility of these machines has been reached, others of heavier design will be substituted, and the lighter machines employed elsewhere, but no great outlay for plant will be made until the development of the mines justifies it. In this respect, at least, the management of these properties is entitled to great credit.

MINE BELL SIGNALS.

It having come to my notice that in some localities the legalized code of mine bell signals is not in use, it appears important to call attention to the fact that the California State Legislature adopted a code of mine bell signals May 1, 1893, which should be adopted by all mines regardless of custom or different practice elsewhere. There is a liability attached for the non-use of the legal signal code. For the benefit of California miners the legal signal code is here published.

California Code of Mine Bell Signals.

1 bell, to hoist. See Rule 2.
1 bell, to stop, if in motion.
2 bells, to lower. See Rule 2.
3 bells, man to be hoisted; run slow. See Rule 2.

4 bells, start pump if not running, or stop pump if running.
1—3 bells, start or stop air-compressor.
5 bells, send down tools. See Rule 4.
6 bells, send down timbers. See Rule 4.
7 bells, accident; move bucket or cage by verbal orders only.
1—4 bells, foreman wanted.
2—1—1 bells, done hoisting until called.
2—1—2 bells, done hoisting for the day.
2—2—2 bells, change buckets from ore to water, or vice versa.
3—2—1 bells, ready to shoot in the shaft. See Rule 3.

Engineer's signal that he is ready to hoist is to raise the bucket or cage two feet and lower it again. See Rule 3.

Levels shall be designated and inserted in notice hereinafter mentioned. See Rule 5.

For the purpose of enforcing and properly understanding the above code of signals, the following rules are hereby established:

Rule 1. In giving signals make strokes on bell at regular intervals. The bar (——) must take the same time as for one stroke of the bell, and no more. If timber, tools, the foreman, bucket, or cage are wanted to stop at any level in the mine, signal, by number of strokes on the bell, the number of the level first before giving the signal for timber, tools, etc. Time between signals to be double bars (— —). Examples:

6— —5 would mean to stop at sixth level with tools.
4— —1—1—1— —1 would mean stop at fourth level, man on, hoist.
2— —1—4 would mean stop at second level with foreman.

Rule 2. No person must get off or on the bucket or cage while the same is in motion. When men are to be hoisted, give the signal for men. Men *must* then get on the bucket or cage, *then* give the signal to hoist. Bell cord must be in reach of the men on the bucket or cage at station.

Rule 3. After signal "Ready to shoot in shaft," engineer must give the signal when he is ready to hoist. Miners must then give the signal of "Men to be hoisted," then "spit fuse," get into the bucket, and give the signal to hoist.

Rule 4. All timber, tools, etc., "longer than the depth of the bucket," to be hoisted or lowered, must be securely lashed at the upper end to the cable. Miners must know they will ride up or down the shaft without catching on rocks or timbers and being thrown out.

Rule 5. The foreman will see that one printed sheet of these signals and rules for each level and one for the engine-room are attached to a board not less than twelve inches wide by thirty-six inches long, and

securely fasten the board up where signals can be easily read at the places above stated.

Rule 6. The above signals and rules must be obeyed. Any violation will be sufficient grounds for discharging the party or parties so doing. No person, company, corporation, or individual operating any mine within the State of California shall be responsible for accidents that may happen to men disobeying the above rules and signals. Said notice and rules shall be signed by the person or superintendent having charge of the mine, who shall designate the name of the corporation or owner of the mine.

Section 3 of the law says: "Any person or company failing to carry out any of the provisions of this Act shall be responsible for all damages arising to or incurred by any person working in said mine during the time of such failure."

AMADOR COUNTY.

Since the publication of the last report of the State Mining Bureau on the mineral resources of the State, Amador County has taken a leading place in the movement toward modern mining practice. The old-time mining methods, in many cases, have been cast aside for more modern ideas, and it may be said that a new era in mining has only commenced.

In this county are a number of the deepest mines in the State, as well as some of the most valuable. Since the early days of mining in this county, it has been the common belief that the essential feature of a paying mine in Amador was a contact of greenstone and black slate. The development of the last few years has proven that this is not absolutely necessary, for some of the best ore-shoots found in this county are in amphibolite schist, and not associated with any contact. Another erroneous impression has been that all ore-shoots must necessarily be found in connection with the black clay slates of the Mariposa beds. To such an extent has this belief obtained, that it was considered almost useless to look elsewhere for paying mines. Investigation of the past season has demonstrated beyond a doubt that the clay slates of the Mariposa beds have little bearing upon the value of the ore deposits, and that the black slates found associated with these ore deposits are the result of an alteration of diabase tuffs, and may usually, if not always, be readily distinguished from the clay slates. Moreover, the ore deposits do not occur for any considerable distance on the contact of these slates and the massive greenstone, but are independent of them throughout the county. This subject has been treated at some length in the opening paragraphs of this volume.

Between the southern limits of the town of Jackson and the Mokelumne River on the Central Gold Belt, there are at present no mines which are paying, although active operations are in progress on several properties included in that section and profitable mines may be developed. The first mine, coming from the Mokelumne River northward, which may be included in the paying class, is the Zeila Mine. In this county, since our last report, a number of old mines have been reopened, after an idleness of years. The most important of these are the Oneida, Central Eureka, Lincoln, and Bunker Hill, descriptions of which will be found in the following pages. The Baliol Mine, near Sutter Creek, is a new mine which has been extensively equipped and developed since the publication of the last report.

Amador Queen No. 1.—This mine is 1½ miles south of Jackson. The shaft has been sunk to a depth of 1200 feet, with extensive development at the 160, 300, 500, 1100, and 1200 foot levels. All of the workings of the mine are in amphibolite schist. Heavy gouges are an important and characteristic feature of this mine. There is a broad zone of schist, much foliated and contorted, with the frequent occurrence of seams and veins of quartz, with occasional high values; galena and free gold are often observed. Between the 1100 and 1200 foot levels a new shoot of ore has recently been discovered, which is one of the most promising observed in the mine. The shaft in this mine has two compartments, and is sunk at a cost of about $30 per foot. Power is furnished by water under a head of 270 feet, and transmitted by Manila ropes to the hoist. There are 15 men employed.——The Jackson Exploration and Development Company (Ltd.), owners. James E. Dye of Jackson, superintendent.

Amador Queen No. 2.—It is 1½ miles south of Jackson, and west of Amador Queen No. 1. The mine is opened through a cross-cut tunnel run 1000 feet to the vein, where a station has been cut underground and a double-reel hoisting plant installed. It is run by water power from a reservoir situated on the hill above, the pipe-line being conducted through an old shaft. There is a head of 312 feet at the hoist. A three-compartment winze has been sunk at a uniform angle below the adit, the vein dipping irregularly. In January last, the shaft was down 730 feet below the tunnel level. The vein occurs in amphibolite schist, and is chiefly interesting for the amount of arsenical sulphide (mispickel), rich in gold, which it contains. This ore is shipped; all work done in the mine is performed by hand, no machines being in use. The property is equipped with a 20-stamp mill; 19 men are employed.——The American Improvement Company of Toledo, Ohio, owners. John R. Phillips, superintendent.

Anderson (*New York*) *Mine.*—It is 3 miles southwest of Jackson, near Jackson Creek. The mine consists of a number of ore-shoots or mineralized zones, which occur in a dense aphanitic rock, the exact character of which has not been determined—probably a diorite-porphyrite. The ores are found in the crushed portions of this mass, and consist of impregnations of iron sulphides, free silica, and gold. The oxidation of these deposits has resulted in the formation of silicious iron ores carrying free gold. The mine is developed by means of three tunnels: one a cross-cut, 900 feet in length; the second a cross-cut and drift, 300 feet; the third a drift, 150 feet. A winze has been sunk in the latter 70 feet in depth, with a cross-cut 100 feet. In addition to this there are numerous superficial pits and open cuts along the croppings. There is a building for a 20-stamp mill on the property. In this at one time a Huntington mill was in use, in which was crushed

2500 tons of this ore, but a mill of this type is not well suited to the extremely hard, dense ore found in this mine. A ditch carrying 400 inches of water, which at the mine has 300 feet head, is a portion of the property.——W. G. Anderson of Jackson, owner.

Butte Mine.—It is a prospect 5 miles southeast of Jackson, near Jackson Butte; is opened by means of a tunnel, and has a 10-stamp mill. A small force at work. Not visited.

Spagnoli Mine.—This is at Clinton. The property was being operated last spring by the Hobart Gold Mining Company of San Francisco. It has an old inclined shaft 110 feet in depth, and a new vertical shaft 220 feet in depth. The vein occurs in granite. The mine was not visited.——S. N. Spagnoli of Jackson, owner.

Peerless Mine.—It is 2 miles southwest of Jackson and about 3 miles south of the Kennedy Mine. An inclined shaft has been sunk at or near the contact of black clay slates of the Mariposa beds, which occur on the foot-wall and a diabase tuff on the hanging-wall. At the surface was discovered a small vein of quartz, which prospected well in gold. There are 10 men employed.——Peerless Mining and Development Company of Jackson, owners. Henry Osborne of Jackson, superintendent.

Kirkwood Mine.—A new property adjoining the Peerless on the south. It is in the prospective stage.

Zeila Mine.—It is in the southern limits of the town of Jackson. Since the last report, the shaft has been sunk from 1160 feet, at which depth it had remained for some years, to 1506 feet, the lowest level being opened at 1350 feet. The mine was first worked about forty years ago, and continuously for the last twenty-one years. The property has a 40-stamp mill, which was worked steadily for fifteen years, when the mortars of old style were replaced by modern heavy mortars, provided with liners, etc. A modification of the Nevada square-set system is employed in timbering this mine. It is substantially the same as that used at the Utica Mine, Angels, Calaveras County, but was first introduced in the Zeila Mine.

The Zeila ore-shoot occurs as a broad zone of amphibolite schist and quartz, 30 to 40 feet wide. The ground is heavy and expensive to hold. Never a rich mine, it has always, however, paid a small profit. Filling is necessary in working this mine, and is obtained from the vein and also from chambers cut in the hanging-wall. The chlorination works at this mine have been entirely replaced once, and the hearths renewed several times; a hearth usually lasts about five years. The manager states that the average expense of mining and milling at the Zeila is about $3 per ton. In recent years a canvas plant has been added to handle the tailings from the mill. 115 men are employed.——Zeila

Mining Company of Jackson, owners. W. F. Detert of Jackson, superintendent.

The Zeila Mill.—The mill, which is under the direction of B. F. Taylor, has 40 stamps which weigh 818 pounds, new. The rock is crushed at the hoist with Blake breakers 9x15 inches. The mill is supplied with Hendy Challenge feeders. The stamps drop 7½ inches, 87 times a minute. The screen used is No. 16 brass wire. The discharge is 7½ to 9 inches high; it is regulated by the introduction of 2-inch differential chuck-blocks. The capacity is 4 tons daily. There is one inside plate on the chuck-block. The pulp from the screen falls against a splash board and drops upon an iron plate (the lip of the mortar), from which it drops 1 inch to an apron plate 51 inches wide by 30 inches in length; thence it passes to the sluice plates 16 inches wide by 120 inches in length. The pulp passes by launders to the vanners. The free gold constitutes but 35 per cent of the values. The plates are dressed daily and a clean-up made monthly. Experiments have shown that while finer crushing will result in saving more free gold, there is a greater loss of values in sulphides, due to sliming of the ore. The iron shoes and dies last 100 days, crushing 400 tons of ore. In the Zeila mortars there is a tendency of the center shoes and dies to wear more rapidly than those at the end of the mortar. Raw copper plates are used, and it is rarely the amalgamators have any trouble with copper salts or spots of any kind on the plates which have never been silvered. This is considered due to the character of the ore, consisting largely of chlorite schist with quartz, and containing no rapidly decomposing sulphides. Mr. Taylor, mill foreman, states that but twice has he ever detected visible gold in the ore. The sulphides occur to the amount of 2½ per cent, and have a value of about $100 per ton, which is in strong contrast with other mines where the average value of the ore is higher than at the Zeila. At the chlorination works, 7800 pounds of sulphides are treated daily in three charges of 2600 pounds each. The furnaces are 60 x 11 feet, inside measurements. The Plattner process is employed.

The Zeila Canvas Plant.—The slimes plant is located at the mill. Owing to the fact that the issue from the mill is near the creek level, the tailings are elevated by a centrifugal pump to a height of 13½ feet to a hydraulic sizer or separator; 6½ inches (miner's) of water are required to run the pump under a head of 150 feet. The daily output of tailings consists of 32 inches of water and about 150 tons of sand, the output of a 40-stamp mill. The hydraulic sizer, which is a modification of the well-known German spitzkasten, is an invention of Mr. Hambric, who is in charge of the plant. The accompanying illustration (Fig. 3) will give an idea of the construction and operation of this device. The pulp falling into the separator, passes into the first upright pipe in the box, in which is a smaller pipe with a jet of water under pressure. This

causes a violent ebullition of the sands, the coarser particles of which pass out at the bottom, the finer rising from the tube, re-entering the separator and passing onward to the second pipe, where it undergoes a similar operation by means of a second hydraulic jet. Here the sands pass out at the bottom, the slimes rising as before and passing out through a launder opposite the end at which they enter. The coarse material from the separator goes to two canvas tables, which accumulate about 1½ tons of sulphides per month; the grade of these tables is 3 inches in 1 foot, which is the heaviest grade in the plant. Tailings from these tables go to waste. The finer pulp from the separator goes

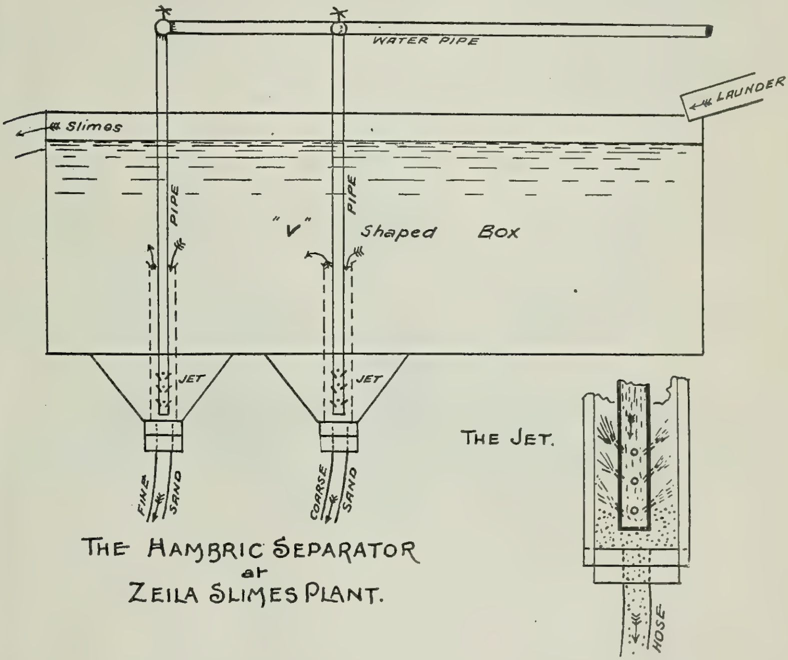


FIG. 3.

to the tables of the main plant, which are in a building 58 x 140 feet. The plant consists of 32 main tables, 10 x 12 feet, and 8 auxiliary tables, for the purpose of taking the overflow when purifying the tables of the main plant. The grade of these tables is 1¼ inches to the foot. The pulp is divided into four equal portions outside the building, and is evenly distributed on an inclined plane provided with ribs 3 inches apart, ¾ inch deep, and ½ inch wide. Along these channels the pulp flows to the canvas tables. There are eight divisions at the upper end, which grow less in number as each table is passed, until the last of the series is reached, where there is but one. At the head of each table is a

Zeila Canvas Plant, Jackson.

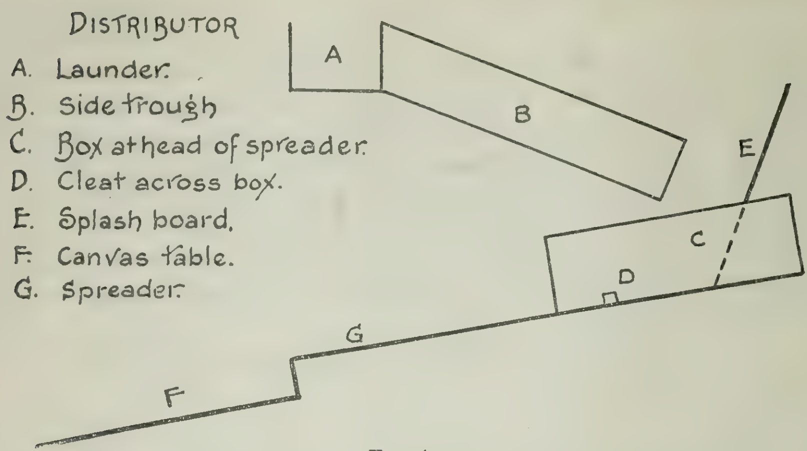


Fig. 4.

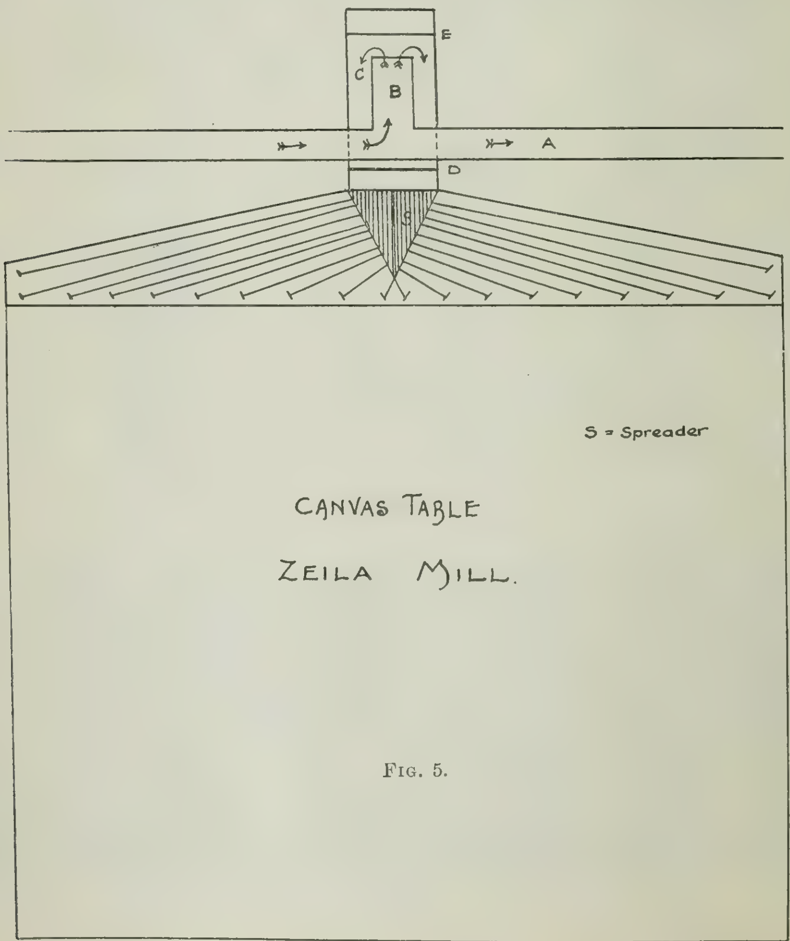
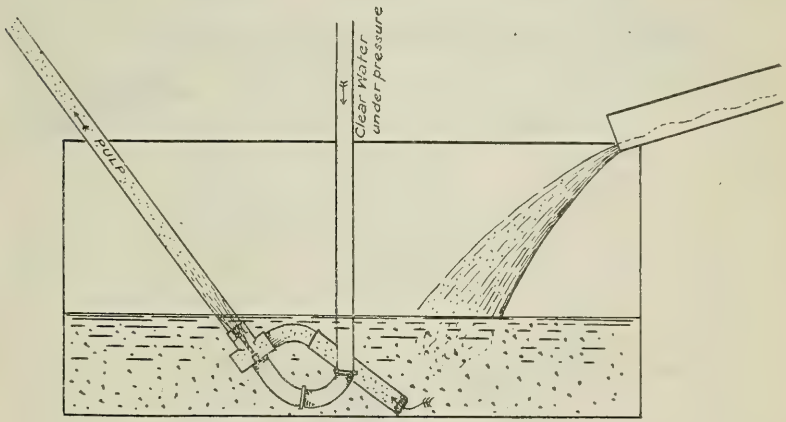


Fig. 5.

distributing device illustrated in the accompanying sketches (Figs. 4 and 5). Throughout the length of the plant clear-water pipes are provided with faucets opposite each distributer, and between each of two tables is a hose for washing the tables. At this plant the owners undertook a series of experiments, of which the chief feature was the discontinuance of purifying the material concentrated on the canvas, by washing off the lighter sands before collecting the sulphides. At this writing (June 10th) the result of this experiment has not been ascertained. At the foot of the tables are two launders, one for waste, the other for sulphides collected on the tables. These are kept separate by means of a movable bridge or apron. The washings from the tables are re-concentrated on a belt machine, 1000 pounds being reduced to 900 pounds. All pulp from the tables is elevated by means of two



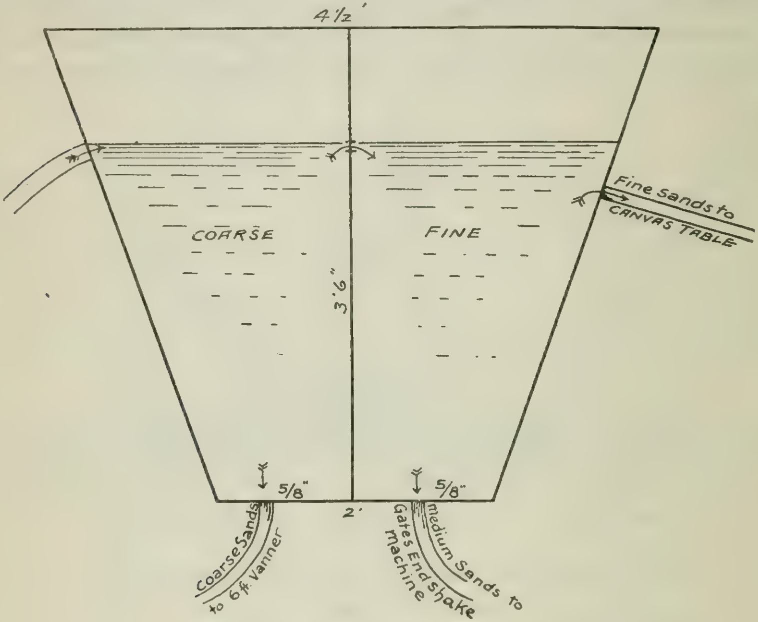
HYDRAULIC EJECTOR or PUMP at ZEILA SLIMES PLANT
Jackson, - Cal.

FIG. 6.

hydraulic ejectors, the construction and operation of which is illustrated in the sketch (Fig. 6). The pulp passes to a box having the form of an inverted truncated pyramid, 4½ feet square at the top, 18x24 inches at the bottom, and 3½ feet deep. The construction and operation of this device is shown in Fig. 7, on p. 50. As previously stated, the practice of purifying at this plant has been discontinued; the experiment has demonstrated that by sending the concentrates from the tables to the pointed box effects a saving of from 12 to 15 tons per month, but it also results in lowering the grade of concentrates. The economic result, however, has not been determined. No. 8 canvas is employed in this plant, and lasts one year. Canvas for the complete plant costs $175. The wear and tear of the plant is stated to be about $25 per month; the

plant cost complete about $6,500.——Groome & Hambric of Jackson, owners.

Argonaut Mine.—One mile north of Jackson, adjoining the Kennedy on the south. The inclined shaft commenced in 1893 has now reached a depth of 1750 feet, at which point it was stopped by an injunction of the court, pending a settlement of litigation with the Kennedy Company. Above this level the mine has produced a large amount of ore, which has been crushed in a 40-stamp mill with large profit. The shaft not being sunk on the vein, a series of raises have been driven, which prove this vein to be continuous from the surface croppings to



POINTED BOX - ZEILA SLIMES PLANT.

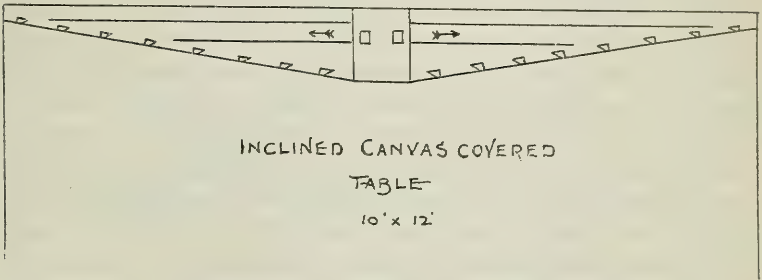
FIG. 7.

the lowest workings. The mine is equipped with a heavy hoisting plant, capable of working to a depth of 2000 feet. It is run by water, the power being communicated by means of rope transmission. The litigation between the Argonaut and Kennedy companies, in which the former company is plaintiff, is still pending. The geology of the Argonaut, and of the Kennedy Mine adjoining, will be treated in a separate paragraph following the description of the Kennedy Mine. There are 140 men employed.——Argonaut Mining Company of San Francisco, owners. J. B. Francis of Jackson, superintendent.

Argonaut Mill.—The rock is crushed in the breaker at the hoist and delivered to the mill bins, from which it passes by chutes to Challenge

feeders. The mill is in charge of Mr. B. Taylor. It has 40 stamps, which drop 7 inches, from 90 to 95 times per minute. No. 30 brass wire screen is used. The height of discharge is 8½ inches, which is kept as nearly uniform as possible by the use of several chuck-blocks. The capacity of the mill is somewhat variable, owing to changing characteristics of the ore, but it is about 3.25 tons per stamp daily. The quantity of water used in the battery also varies with changes in the ore. The apron plates have a grade of 2 inches to the foot, and the sluices 1⅝ inches per foot. These are dressed daily; the mill is cleaned up monthly.

Some experiments of an interesting character were made at this mill. The pulp was passed through a hydraulic sizer, the coarser material being sent to a Woodbury bumping-table, and the finer to Union and Woodbury belt machines. The coarse material treated by the bumper returned high values, and the fine material from the belts was of medium



PLAN OF GROOM DISTRIBUTOR - Argonaut Slimes Plant.

FIG. 8.

value. This probably represents the two classes of sulphide material found in this mine; a coarse, high-grade sulphide occurring in the quartz, and a fine, low-grade sulphide found in the slaty ores. Another experiment made at this mill was that of re-cleaning all the concentrates from fifteen machines by passing the concentrates of all these machines over one Union belt machine, with the result that 12 to 15 per cent of low-grade, silicious material, worth about $10 per ton, was segregated from the concentrates, which shows that previously a large quantity of material had been shipped away at a loss, as it contained less value than the cost of transportation and treatment. As the material thus segregated consists largely of quartz with gold, and a small amount of iron sulphide, it would seem that a considerable percentage might be recovered by grinding the sands in some sort of mill or pan with quicksilver.

The Argonaut Slimes Plant.—Mr. F. S. Groome has built and operates a slimes plant below the Argonaut mill—the pulp coming

directly from the mill to hydraulic separators, or spitzkasten, and passing thence to the distributers, the construction of which is illustrated in the accompanying sketch (Fig. 8). In size, the tables of the main plant are 8 x 16 feet. The sized pulp is distributed to three sets of tables, the coarse going to a set of three tables; the medium, which constitutes the larger portion of the material, passing to sixteen tables, and the finest material to a third set of three tables. The fall of the tables treating the finest material is 1⅜ inches in 12 inches; the grade of the medium tables is 1½ inches in 12 inches, and that of the coarse 1⅝ inches in 12 inches; these grades are adjustable. The tables are covered with No. 8 canvas. Owing to the topography of the ground, it was not necessary to construct these tables in a series of steps lengthwise of the plant, as in the case of most plants of this character. The canvas is placed on the long lines of tables in a single piece, reaching the entire length of the plant, tacked at the edges, and then the entire floor is divided into a series of tables by tacking down 2-inch strips at regular intervals. The pulp is run for one hour on the canvas table; it is then shut off, and clear water turned on for about five minutes, when the sulphides are removed by means of a hose, usually taking one minute to the table. It takes one man forty-five minutes to make a complete round, and about fifteen minutes to look after the outside machines. In this plant, as at all others, at the foot of the tables is a double launder—one to carry the waste tailings, the other to carry the concentrates accumulating upon and washed from the tables. The concentrates from the tables are sent to an agitator, which re-sizes the material, the finer going to additional tables having a grade of 1⅛ inches in 12, the coarser material going to a belt concentrator, the tailings from which are pumped to an outside table 24 feet in length, the overflow from which goes to a second set of three tables. The changes in the ore necessitate slight modifications in the treatment. About 125 tons of material are treated daily. Of the values that come from the mill, contained in the tailings, about 35 per cent is actually saved, 65 per cent escaping in the coarse quartz sand, the gold being evidently bound up in the quartz grains, which would require a finer crusher to liberate it; but attempts made heretofore to save this gold at a profit have proven abortive. It would seem, however, that if this material were crushed in a mill of proper construction, operated at a minimum cost of power, it might yet afford a small profit. In the construction of this plant, green redwood was employed. The foundations were firmly bedded, and the entire plant constructed with greatest care.

Kennedy Mine.—It is 1 mile north of Jackson, adjoining the Argonaut on the north. This property has been repeatedly described in former reports of the State Mining Bureau, but as it is one of the most prominent mines in the State, it merits further mention. The mine has

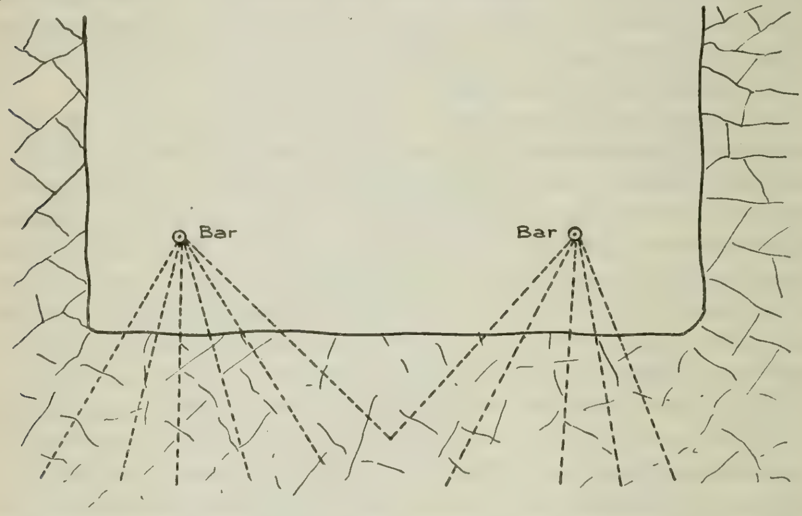
been worked continuously since 1885, when work was resumed at a depth of 750 feet, to its present depth of 2300 feet vertical. About 36,000 tons of ore have been crushed annually for the past fourteen years, at an approximate cost of $4.50 to $5.00 per ton, which includes the cost of mining, supplies, insurance, taxes, superintendence, purchase of property, dead work, and new work. This excessive cost is due largely to the heavy swelling ground and the cost of keeping the mine open. Since the last report, the two main shafts have been sunk several hundred feet, and a new vertical shaft has been started on the hillside about 1900 feet east of the old workings. This shaft, in January, had reached a depth of 915 feet; at this writing (June 12th), it is over 1300 feet deep. A cross-cut is being driven from the 2100-foot level of the Kennedy Mine to connect with the new vertical shaft. The general geological structure of the mine is referred to in a paragraph below, which also includes that of the Argonaut Mine adjoining.

The distribution of ore-shoots in the Kennedy-Argonaut vein is of considerable importance to miners along the Gold Belt, as in these extensive workings it has been shown that ore-bodies are not absolutely continuous, either longitudinally or in depth, and that workings can be driven over the top and along either side of an ore-shoot, and beneath it, in fact completely surrounding it, in a barren fissure. There are ore-shoots in the Kennedy Mine that do not approach within several hundred feet of the surface. On the 2100-foot level a new shoot was recently discovered which started on the west or foot wall (diabase), dipping at an angle of approximately 40 degrees eastward with a trend to the southward, which is contrary to the usual trend of ore-shoots in this mine. The main north shoot is wholly distinct and separate from that on the south, and it is also distinctly different in character. At the south end of the south shoot, several small veins come in from the hanging-wall side, uniting with the main fissure, and these gradually build up the large south ore-body.

The principal feature of interest at the Kennedy Mine at present is the new east shaft. The object of this expensive piece of work is to make the large bodies of low-grade ore exposed by development in the mine available at a decreased cost. This shaft has been sunk through hard greenstone at a rate approaching three feet per day. This was accomplished by the use of four machine drills, working three shifts. Arrangements were so made that the timber gang could work uninterruptedly while drilling was in progress below. The machines are set on two bars disposed near the end of the shaft, and after having been set in place a full round of holes is put in, from 28 to 35 in number, without taking down the machines. The holes are drilled from 5 to 6 feet vertically. The manner of pointing these holes is shown in the

accompanying diagram (Fig. 9). There is no hand-drilling, all work of squaring-up, etc., being done with machines. In this shaft 26 men are employed. The shaft is timbered throughout with 12 x 12 Oregon pine; sets 5 feet from center to center near the top, and in the lower portion 6 feet from center to center. The accompanying illustration (Fig. 10) shows the relation of the strike of the rocks to the position of the shaft. (Notice also the strike of rocks in the Oneida and Wildman shafts in this county—see Figs. 14 and 21.)

An unusual feature in the new Kennedy shaft, not often found in shafts sunk in hard rock, is the bridge used in timbering; this is illustrated in the accompanying sketches (Figs. 11 and 12). It was claimed by Mr. George W. C. Glass, who was in charge of this work, that this



SKETCH showing manner of placing MACHINE-HOLES in KENNEDY SHAFT.

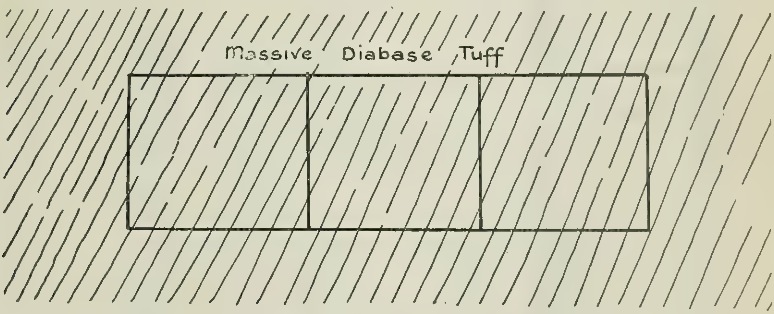
FIG. 9.

method of shaft-timbering greatly expedited matters and was less expensive than by the ordinary method. This manner of timbering shafts is not novel, but is usually employed in soft and not in hard ground; but as the bridges have been carried from top to bottom in this shaft, and as good headway has been made throughout, it is probable that this method has given entire satisfaction in this instance.

The Kennedy Mill.—This mill contains 40 stamps, and is in charge of Mr. Webb Smith. The monthly capacity is about 4,000 tons. The stamps drop 7½ inches 95 times per minute. The height of discharge is from 8 to 10 inches, three differential chuck-blocks being employed to keep these as nearly uniform as possible. The grade of the plates is 1½ inches to 12; 24-mesh brass wire screen is used in the battery,

formerly 30-mesh. The amount of water employed in the battery is variable, depending on the character of the ore. Cast-iron, chilled, manganese, chrome, and hammered steel shoes and dies have been used in this mill. The steel shoes and dies have given the best satisfaction; the iron shoes last about 50 days, the steel 95 days, the latter crushing about 340 tons of rock. The plates are dressed daily, and the general clean-up is made monthly. There are 24 Frue vanners in use. The sulphides collected on these machines are treated in the chlorination works at the mine, having a daily capacity of 3½ tons. The average saving is about 94½ per cent, and the cost is said to be $7 per ton, paying high salaries to experienced men.

The mortars used in the Kennedy mill were formerly of a wide type with double discharge, the rear discharge being closed for gold milling. These have all been replaced by narrow, lined mortars, designed by Mr.



SKETCH showing STRIKE of FORMATION across
KENNEDY VERTICAL SHAFT.

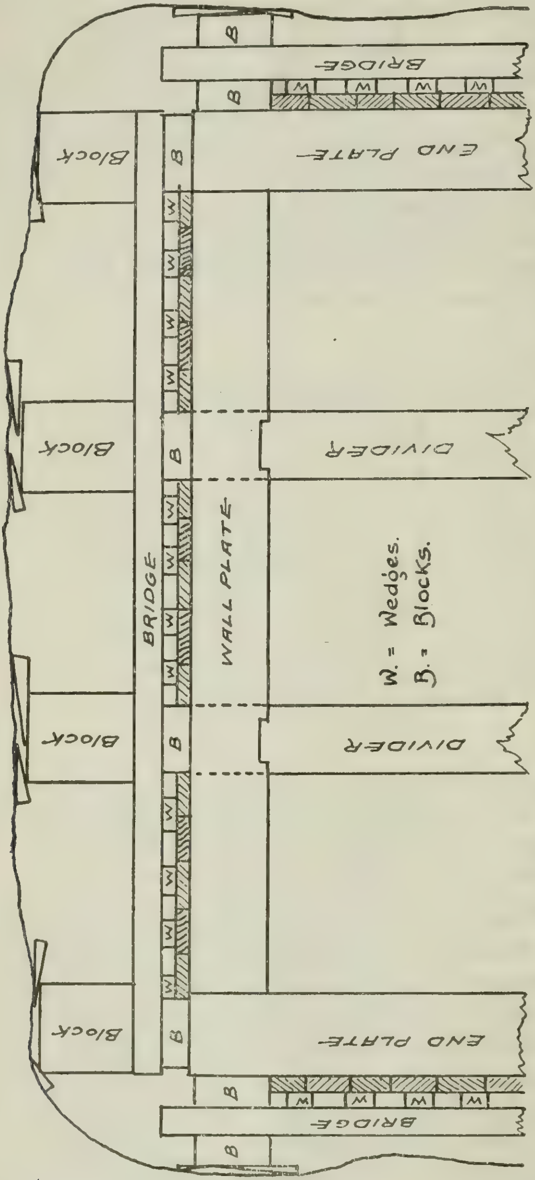
FIG. 10.

Webb Smith, the mill foreman. The mortars are lined throughout, and have a plate on the feed lip which may be replaced when worn. There are 150 men employed.——Kennedy Mining and Milling Company of San Francisco, owners. J. F. Parks, superintendent.

Kennedy Slimes Plant.—All the tailings from the Kennedy mill go to a slimes plant, one of the first built and successfully operated on the Gold Belt. The design is that of G. G. Gates of Jackson, who has carried the concentration of slimes to as near perfection as may be wished. Mr. Gates has also designed an end-shake belt concentrator which does splendid work on slimes. This machine is used in recleaning the concentrates from the canvas tables. The Gates plant is described at length in Bulletin No. 6, "California Mill Practices," by E. B. Preston. Since the publication of that bulletin, Mr. Gates has made no material change in the design of his plant or method of operating, although the plant has been entirely rebuilt. In its general features it is similar to that at the Zeila Mine.——G. G. Gates of Jackson, Cal., owner.

GEOLOGY OF ARGONAUT–KENNEDY VEIN.

In the Argonaut and Kennedy mines is found a perfect example of that class of mineral deposit known as, and called, a "true fissure" vein.



HORIZONTAL SECTION, one side of KENNEDY VERTICAL SHAFT, showing Bridges and Blocking.

FIG. 11.

By the term "true fissure" is meant a vein or fissure which cuts through rock formations of either similar or unlike character, wholly independent of either the dip or the strike of the rocks which form the walls of

the vein. Veins of undoubted fissure type do occur, however, which conform with strike or dip of the wall rocks, and in some instances with both.

That the Argonaut vein is persistent for thousands of feet in both strike and dip is abundantly proven in the extensive workings of the Argonaut and Kennedy mines, the connection of their levels at numerous points showing clearly the identity and continuity of the vein in these mines.

The geology of the vein is very simple and may be briefly stated. That geological horizon known as the "Mariposa Beds" (U. S. Geological Survey), which consists of deposits of clay slate and altered diabase

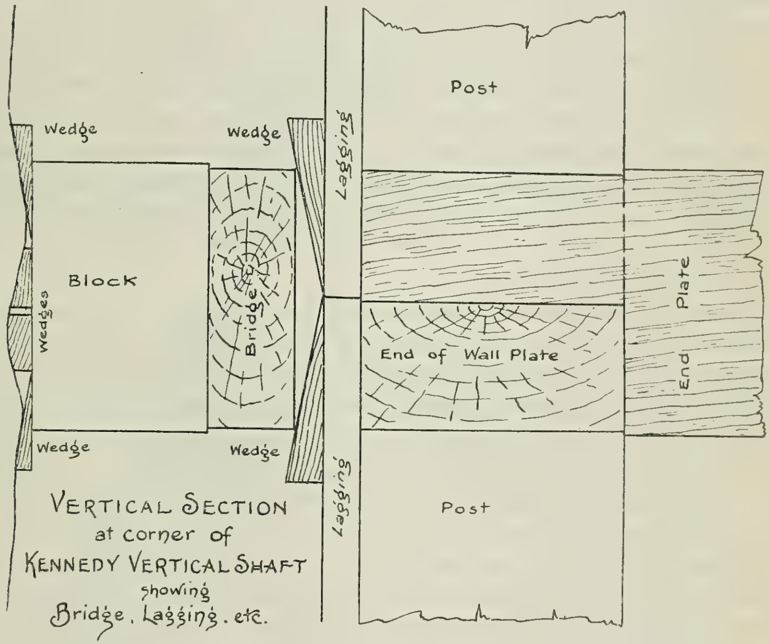


FIG. 12.

tuff, is found intruded by dike-like masses of diabase. These dikes are of varying width, and appear to have been thrust in from the northward, where, at a distance of 1000 feet or thereabouts, to the northward of the Argonaut shaft at the base of Reservoir Hill, the diabase seems to have almost wholly displaced the slates. To the westward of the most westerly of these slate strips is found a broad area of typical diabase (No. 18), mostly massive and granular, extending many thousands of feet to the northward and southward.

When in their normal position and condition, we find the slates of the Mariposa beds along the Gold Belt almost universally dipping to the eastward and striking a few degrees west of north. In the Argonaut

Mine local disturbances have resulted in folding, faulting, and crushing these slates, the degree of foliation and alteration appearing in proportion to the amount of crushing and shearing to which the rock has been subjected. Whether or not the cleavage of the planes of the slates are coincident with the planes of sedimentation cannot be determined, nor is it important. At Sutter Creek it is known that they are not. (For illustration, see Fig. 20, page 67.)

The diabase has also shared in this alteration from the same causes, namely, movement and fracture of the rock-masses due to tremendous compressive stress, resulting in a process of crushing and shearing of this hard, tough, granular rock, and its consequent alteration to splintery, schistose, and slaty rocks, with every phase of transition from granular normal diabase to chloritic schist and slate. (Amphibolite schist, U. S. G. S.) Diabase when so altered to a slaty condition forms the "gray slate" of the miners. The slaty structure developed in the tuffs is often so perfect that in some instances, particularly when found in the vicinity of the black clay slates where they have become blackened by metamorphosing influences, it is extremely difficult and often impossible to distinguish one from the other by their physical appearance. For a description of this type of formation see "Schists and Metamorphic Rocks," by G. H. Williams.

The vein can be followed continuously from its apex in the Argonaut claim to the lowest level of the mine without break or interruption of any kind. The apex or upper portion of the Argonaut Mine is wholly in massive diabase, which is found much decomposed for some distance on either side of the vein to a depth of several hundred feet, but for most part retaining its massive structure. (See Fig. 13.) In proximity to the vein, an alteration to a splintery or schistose condition may often be observed, and impregnations of pyrite are of frequent occurrence where such alterations are found. In the hanging-wall diabase near the surface are found numerous small veins and seams of quartz, some of which lie nearly parallel with the principal fissure plane, but the greater number have a westerly dip extending upward from the fissure into the hanging-wall.

Similar seams and vein-like sheets also occur in the foot-wall diabase, but usually in less number. These attendant sheets and veins of quartz are incidental to many veins elsewhere, and very frequently contain sufficient valuable material to entitle them to be included in the zone of pay rock together with the main fissure, when the entire zone of mineralization is, and very properly should be, considered as a single vein or lode. In making an examination of the vein structure and wall rocks in a raise extending upward from the 470-foot level to the adit (Pioneer tunnel) level of the Argonaut Mine, geological conditions were found to exist which at once determined the fact that the vein

occupies a "fault fissure," the hanging-wall having moved upward relatively to the foot-wall, constituting a "thrust" or "reverse" fault. There may possibly have been also a lateral movement along the fissure plane to the southward, striations found on the walls of the vein dipping to the northward tending to strengthen this belief. The amount of displacement as determined by measurement in the raise is about 125

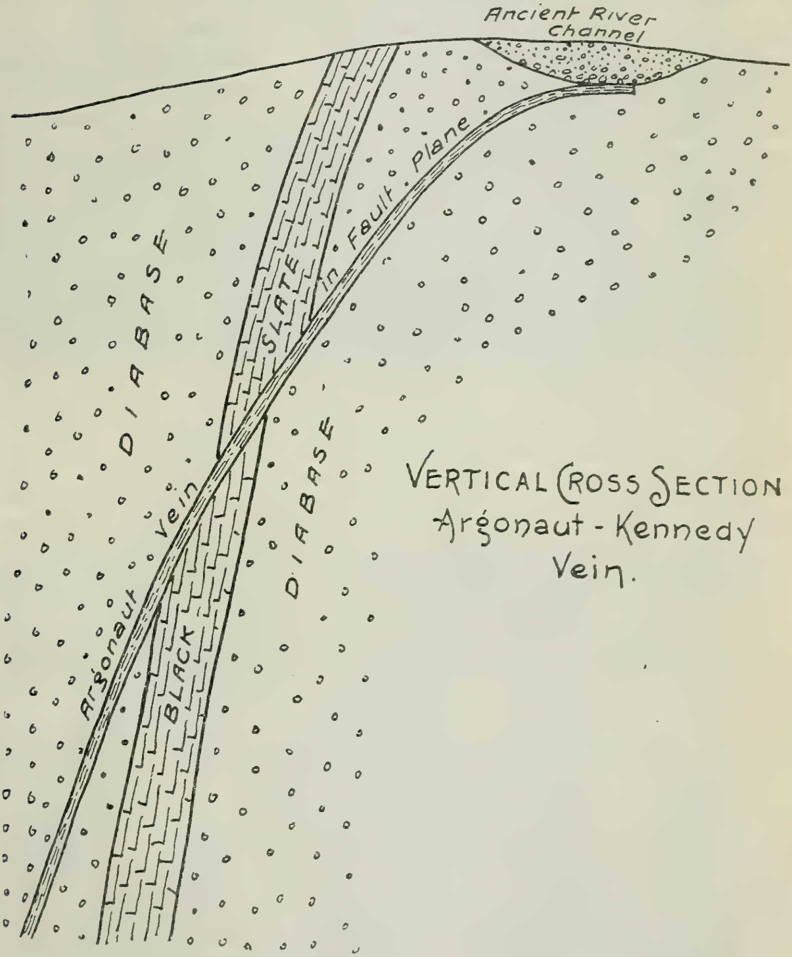
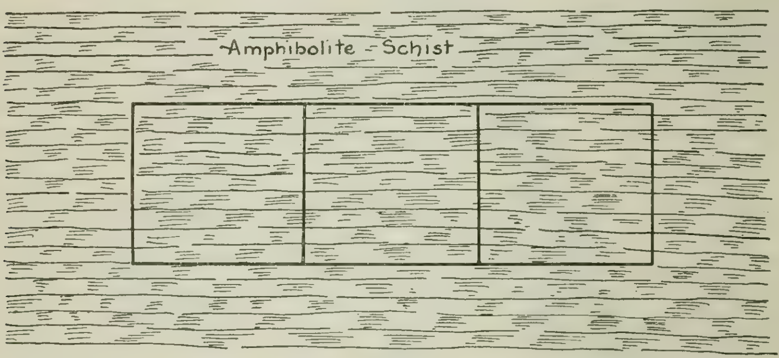


FIG. 13.

feet. The quartz occurs along this plane in a most persistent manner, and is rarely absent, even for a short distance. In width the quartz varies from 1 to 2 inches to upward of 30 feet. Where for a brief space quartz disappears in the raises above the 470-foot level, the gouge resulting from attrition caused by movement of these rock planes upon each other, which always accompanies this vein, clearly indicates the

plane of the fissure. In passing through these raises it may be noticed that where no quartz appears in the fissure on one side of the cutting, it may usually be found on the opposite side. No more conclusive evidence of a continuous vein than the fact that it occupies a fault plane could be desired.

It may be contended that this vein occupies a contact fissure, but the conditions above described and the abundant evidence found on the several levels of these mines, indicate clearly that any contact is of purely local character, and that the fissure is absolutely independent of it, for the vein does not conform for any considerable distance in either mine, in either strike or dip, to the contact planes of the black slates and the diabase, or the schistose and slaty rocks resulting from its alteration. The dip of the vein varies from a comparatively small angle at the apex to about 67 degrees from the plane of the horizon in



SKETCH showing relation of STRIKE of AMPHIBOLITE SCHISTS to direction of NEW VERTICAL SHAFT.- ONEIDA MINE.

FIG. 14.

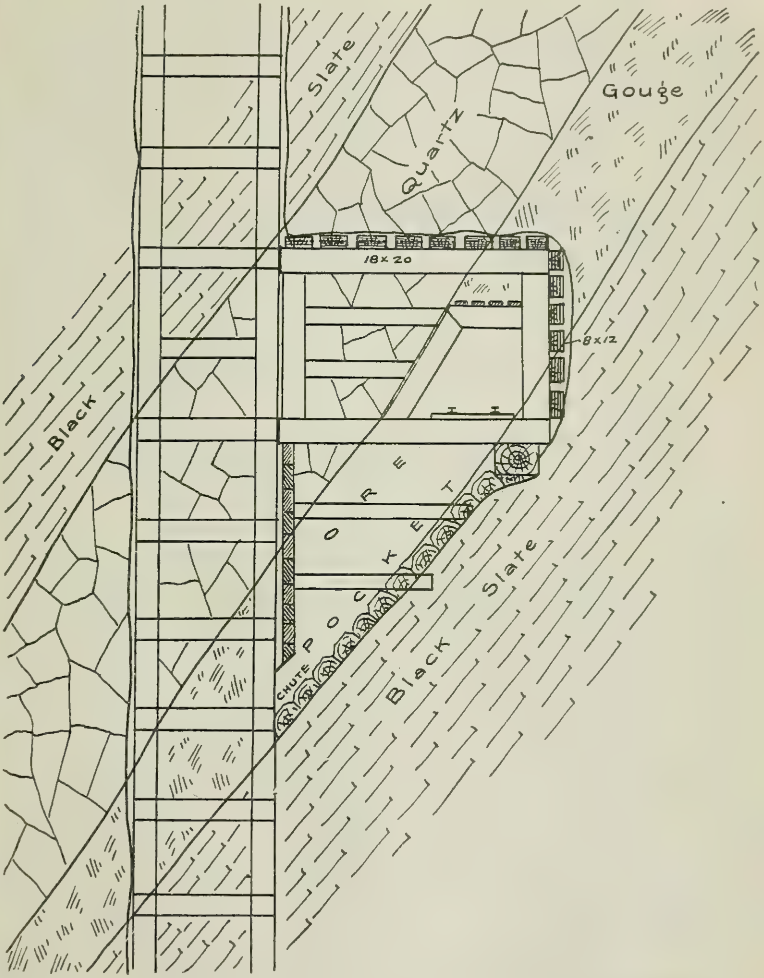
the lower levels, and in general at a somewhat less angle than that of the inclosing rocks.

Oneida Mine.—It is 1½ miles north of Jackson, adjoining the Kennedy on the north. Since the last report, a new vertical shaft has been sunk in the hanging-wall to a depth of 2050 feet. Ground was broken for this shaft January 13, 1896, and February 3, 1896, the shaft had reached a depth of 16 feet, when work was discontinued for the reason of bad weather. On March 9, 1898, the shaft had reached a depth of 1550 feet in two years and thirty working days, making a daily average of two feet. All this work was done by hand, excepting during a short time when machines were used, but their use was discontinued. This shaft was laid out to conform with the strike of the formation. (See Fig. 14.) In this respect it should be compared with the new vertical shaft of the Kennedy (see Fig. 10), and that of the Wildman at

Oneida Mine, Amador County.

The Central Eureka Mine, Sutter Creek, Amador County.

Sutter Creek (see Fig. 21). It is claimed that there is considerable advantage gained in sinking the shaft at right angles with the strike of the formation or diagonally across it. The timbers employed in timbering this shaft were 12 x 12 and 14 x 14 inches. The upper portion, in soft ground, is closely lagged, but the greater part is without lagging.

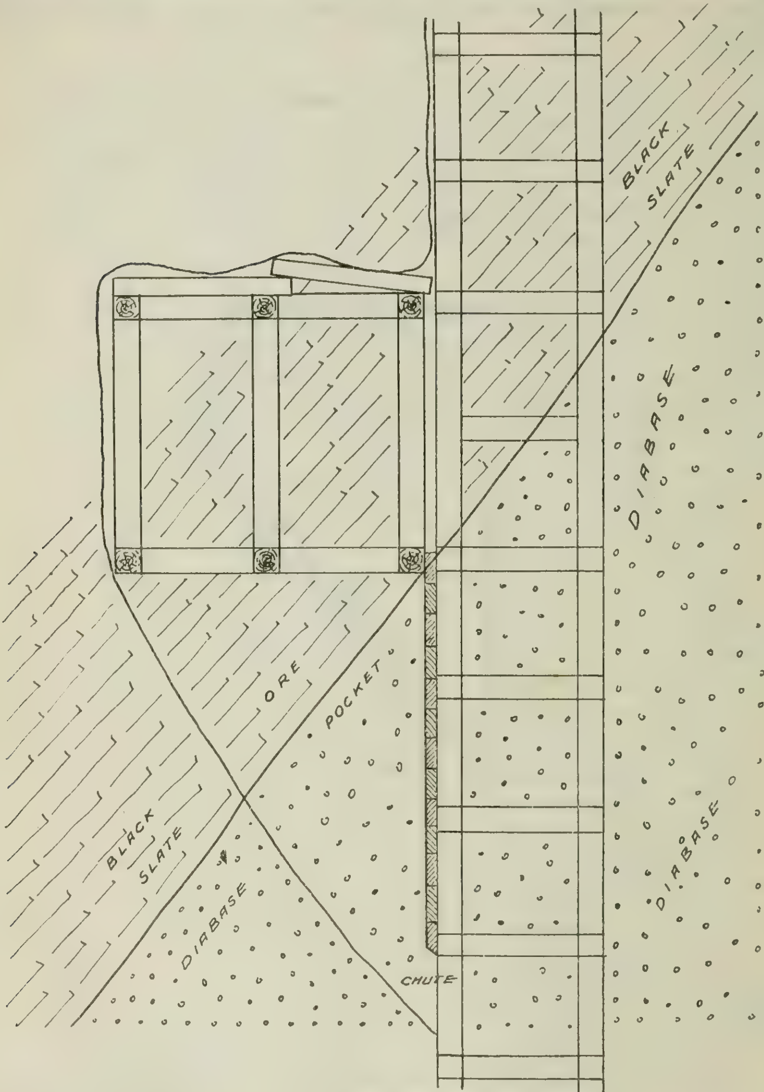


STATION AND VEIN - 1900 ft LEVEL. Oneida Mine.

FIG. 15.

Three ore-shoots have thus far been discovered in the mine, two of them near the shaft and the third north of it. The best ore developed is found on the 1500-foot level, although ore has also been developed on the 1700 and 1900 foot levels. The old incline shaft which was sunk by the former operators to a depth of 1350 feet has been cleaned

out, a great deal of it being found in a very bad condition. It was probably one of the most expensive and difficult jobs of opening an old shaft that has yet been found on the lode. The new vertical shaft and the old inclined shaft which will be extended downward, will be



STATION AND SHAFT. 2000 ft LEVEL. Oneida Mine, Amador Co. Cal.

Fig. 16.

connected at various levels. The vein crosses the vertical shaft at the 1900-foot station. Here the hanging-wall is diabase and the foot-wall black tufaceous slate. At the station there is a heavy gouge on the foot-

wall side, and a large vein of fine-looking quartz. In the sump 50 feet below the 2000-foot level, and at least 50 feet west of the vein, a thin, flat seam of quartz was found in the diabase of the foot-wall, containing coarse gold. This is an unusual occurrence, or at least one not heretofore observed along the Lode. The method of timbering stations in the Oneida Mine is shown in the accompanying illustrations. (Figs. 15 and 16.)

A new 60-stamp mill is in course of construction at this writing, early in June. It will be necessary to elevate the ore by some means, probably an inclined tramway, from the shaft to the ore floor of the mill; this might have been obviated by sinking the shaft on a ridge a short distance eastward from the present site of the shaft. A large, expensive hoisting plant forms a part of the equipment of this mine. Forty-three men are employed.——The Oneida Gold Mining and Milling Company of West Virginia, owners. C. C. Derby of Jackson, superintendent.

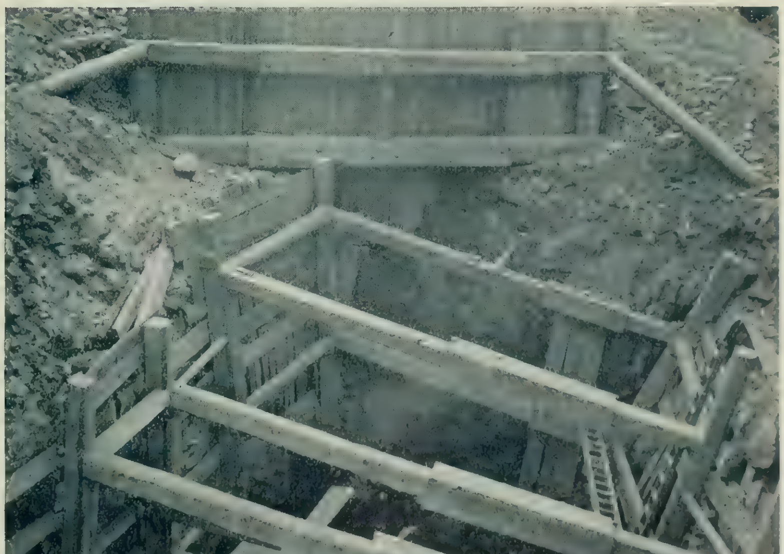
Since writing the above the mill has been completed, and 20 of the stamps dropped early in September, thus adding another producing mine to those operating in Amador County.

South Eureka Mine.—This is one mile south of Sutter Creek, adjoining the Oneida on the north. The north shaft is down 1800 feet, the south shaft 330 feet, connected with the 600-foot level by a raise. This vein occurs in black tufaceous slates and greenstone schists. The ore-shoots trend to the northward and vary greatly in size. The vein is very much disturbed by faults and flexures, which are difficult to understand in the present stage of development of the mine. One perplexing peculiarity of this vein is the finding of rich masses of ore in a large vein of slaty gouge, which have no connection with any continuous ore-shoot. Recently (spring of 1900), some very good ore has been discovered in this mine. Another peculiarity of the ore-shoots is that they are richest in free gold at the north end, while the south end of the shoots are of much lower grade. It seems characteristic of these veins that while they are broad, the values are disseminated. In many of the mines of this county, where the veins exceed 10 or 12 feet in width, the best portion is found next to the foot-wall. In some cases from 1 to 10 feet of rock will be found above the average in grade, while the remaining 15 to 25 feet in thickness will be practically valueless, consisting principally of white, massive quartz. In this mine the superintendent has arranged an ingenious device for hauling timbers into stopes above the level. This consists of two sheaves set above in the raise, with one sheave at the main gangway. A rope is passed over these sheaves and a bucket attached at one end. This bucket is hauled up into the stopes, and a heavy timber attached to the opposite end of the rope down on the level. When the bucket is filled with ore it acts as a counterbalance, and the timber can be hauled up with comparative

ease. The mine is provided with a 20-stamp mill, run by electricity furnished by the Standard Electric Company. The hoist is run by water power under 180-foot head, the power being transmitted by means of a wire rope 600 feet long. There are 30 men employed, except when the mill is running, when there are from 60 to 70.——South Eureka Mining Company, owners. J. F. Parks of Jackson, superintendent.

Central Eureka Mine.—This property adjoins the South Eureka on the north, half a mile south of the town of Sutter Creek. This mine, after an idleness of many years, was reopened by a new company in the fall of 1895. There were several shafts on the property at that time, the deepest being the south shaft, down 700 feet. Since that time the shaft has been continued to a depth of 1700 feet and a number of long levels opened. At about the 1000-foot level, several narrow and short shoots of high-grade ore were developed. As depth was attained and levels driven out, these ore-shoots were found to lengthen and increase in width while maintaining their values, until in the deepest portion of the mine the several short shoots have united, forming a single long shoot. At this writing (January, 1900), the Central Eureka Mine is one of great promise. The vein is the most simple in geological structure of any extensively developed mine on the Central Lode. It consists practically of a single fissure cutting in strike and dip the black tufaceous slates and amphibolite schist which form its walls. The mine has certain peculiarities which are noticeably persistent. One of these is the firmness and regularity of the hanging-wall. The wall is not absolutely straight in strike, but rolls more or less in a series of long swells. The gouge, which is always found on the foot-wall side, also has a sinuous course, swinging toward and away from the hanging-wall. When at some distance from the hanging-wall little or no ore occurs in the fissure, but upon its approach to the hanging-wall the long lenticular masses of quartz which constitute these ore-bodies, begin to form. Another feature of the vein is found in the increasing mineralization of the rock forming the hanging-wall upon nearing an ore-shoot. Although at the time of my visit no cross-cuts had been made in the hanging-wall country from the lower levels of this mine, there is little doubt that considerable portions of the mineralized zone of the hanging-wall will be found to make payable ore, although of comparatively low grade. A considerable quantity of the ore taken from the shoots above described has been milled, returning an average of about $70 per ton. The hoist is run by water power. A 10-stamp mill has been completed and is in operation. The mill has an extension for 10 additional stamps. In September the shaft had reached a depth of 1845 feet, and the vein is from 1 to 12 feet in width between the 1400 and 1800 levels. A new hoist is being put in, and the mill, rockbreaker, and exhaust fan are running by electricity.——Cen-

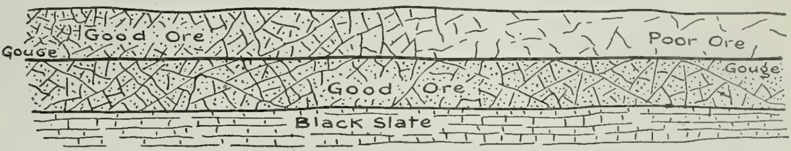
THE MAHONEY MINE, SUTTER CREEK, AMADOR COUNTY.



TIMBERING IN CAVING GROUND, MAHONEY MINE, AMADOR COUNTY.

tral Eureka Mining Company, owners. W. R. Thomas of Sutter Creek, superintendent.

Wildman-Mahoney Mine.—This is at Sutter Creek. The property consists of the Wildman, Mahoney or Hector, and Stewart claims, also the Waechter ranch to the eastward of these mines on which a new vertical shaft is being sunk. The development at present is chiefly confined to the Wildman and Mahoney claims, which join and are operated through two inclined shafts. The Wildman is 1300 feet deep, the Mahoney 1000. The 1000-foot level of the Mahoney is equivalent to the 800-foot level of the Wildman. The ore-bodies of these mines, both great and small, appear to be confined to a definite zone lying between two reefs of Mariposa clay slates, although these latter appear not to be directly associated with the ore-bodies themselves. The zone included between the clay slates consists principally of amphibolite schist and tufaceous black slates. In the southern portion of the Wildman Mine the ore zone is confined to narrow limits, but going northward it broadens, and in the Mahoney claim the vein splits into two sections, the east

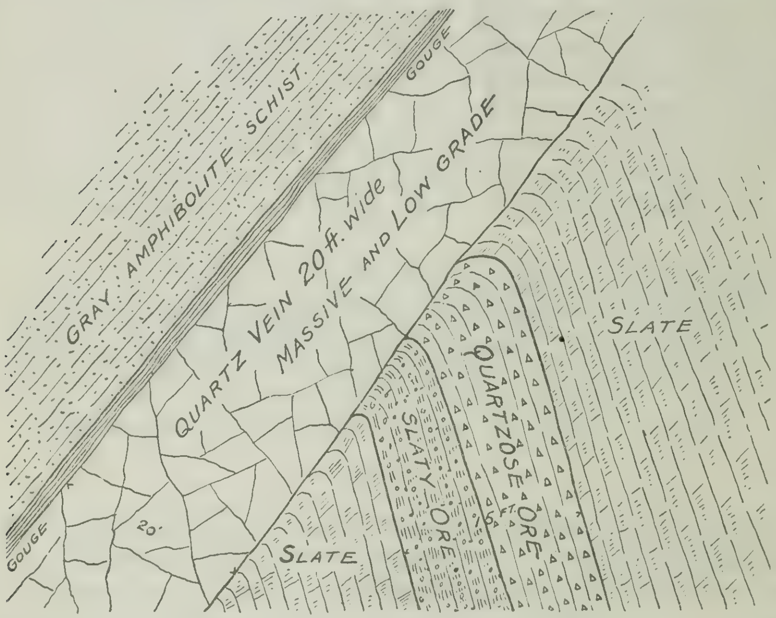


Good ore lying each side of a 3ft Gouge in Wildman Mine

FIG. 17.

branch going into the Stewart claim and the west into the Lincoln. The idea seems to prevail that the mines of the Gold Belt of Amador County are simple fissures, which are easily followed and are regular and persistent. Just the reverse, however, is usually the case, as the ore-bodies are found disturbed by faults, and often contorted and displaced in a most puzzling manner. On the 300-foot level of the Mahoney Mine one vein follows a gouge 4 feet wide, on the hanging-wall of which the ore continues for a distance of 300 feet; going southward for some distance the ore loses its value, but undergoes no physical change that is noteworthy. Noticing that the gouge contained small masses of good ore, from 20 to 400 pounds in weight, Superintendent Ross cross-cut into the foot-wall and found good ore in the opposite side. (See sketch, Fig. 17.) This was the only place known, up to that time, where pay ore was found in the gouge. The ore found on the foot-wall side of the zone was 15 feet wide, but its length has not been determined. These ore-shoots are known to overlap 25 feet at least, and probably much more. Another instance of irregularity was noticed in the Mahoney Mine 30 feet

above the 900-foot level, where is found what appears to be a displacement of a banded vein 15 feet in width, which, together with the inclosed slates, is contorted and cut off abruptly, the sheared end abutting against a solid vein of quartz 20 feet in thickness. (See Fig. 18.) The continuation of this faulted vein has not, as yet, been found above. The slaty material found underneath the banded vein is also gold-bearing in paying quantities. A stope on the 900-foot level of the Mahoney follows a well-defined, persistent wall for a long distance. This stope is 25 feet in width. A fissure crosses the ore-shoot at an angle of 65 degrees, dipping south. Beyond this was found the above described disturbance.



FAULT on 900 ft. LEVEL of the MAHONEY MINE, Sutter Creek.

FIG. 18.

On the 1000-foot level of this mine, a stope follows what appears to be the wall above described, with large ore deposits on either side of the wall. The wall takes a slight flexure to the west, and the ore follows the wall on the foot side, while that previously followed on the hanging-wall side bears more to the east, and a slate horse separates them. In the main level, the drift continues south, and a new ore-shoot comes in from the east or hanging wall. A diamond-drill hole run west, here passes through 6 feet of slate and cuts 3 feet of quartz, which is succeeded by 22 feet of slate and 6 feet of ore. This probably represents the two branches of the divided vein. The diamond-drill hole continues for a distance of 204 feet, where it cuts a vein of good ore 13 feet

thick. This may be the downward extension of the ore dipping westerly on the level above, though such a thing is far from certain. In the

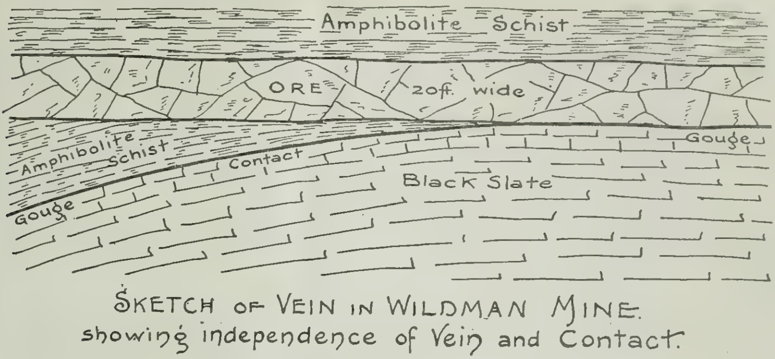


FIG. 19.

Wildman Mine, on the 800-foot level, is a 24-foot ore-body on the slate foot-wall. On the 1000-foot level of the Mahoney, what is evidently

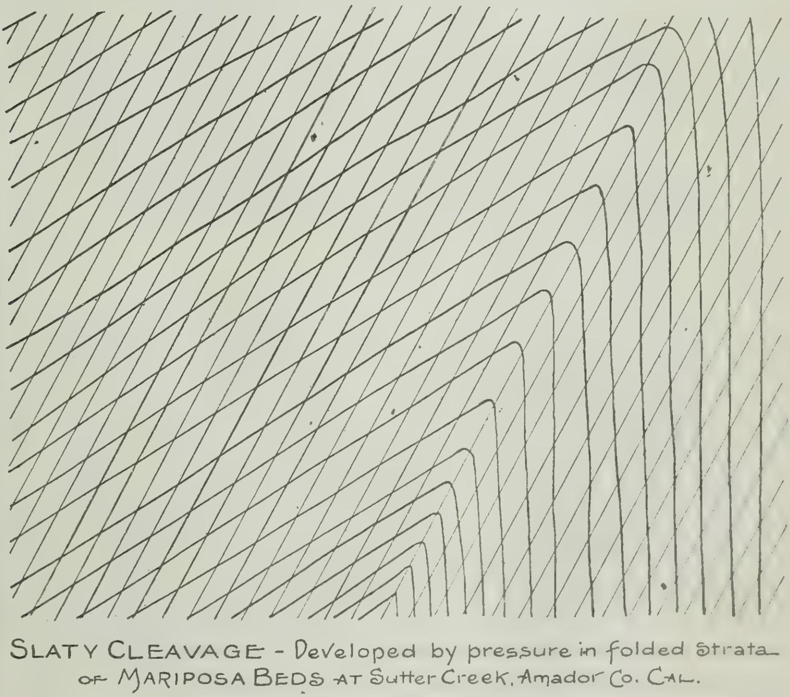
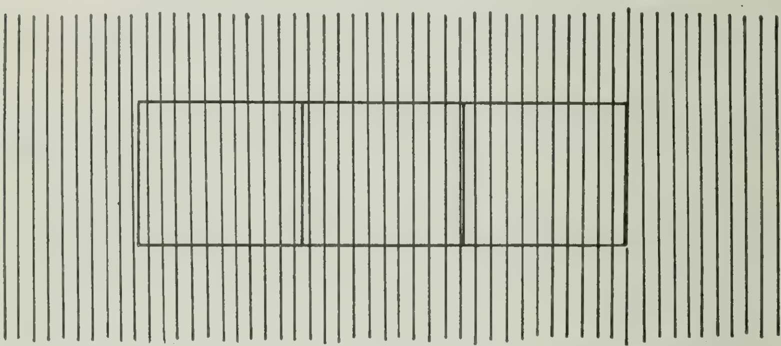


FIG. 20.

this same ore-body is developed, but it lies 23 feet east of the slates (Fig. 19). These irregularities are only a few of those which occur

throughout this extensive property, and are simply mentioned to illustrate the peculiarities and irregularities of the ore-deposits. A complete description of the mine, taken by levels, would fill a good-sized volume. The Wildman-Mahoney Mine labors under great disadvantage in being obliged to work through the old inclined shafts, that of the Wildman Mine being particularly bad, and the cause of what would be otherwise unnecessary expense. The completion of the new Emerson shaft, below described, will remedy this trouble, and the large bodies of ore, too low-grade to pay under existing conditions, can then be worked at a profit.

Fig. 20 illustrates the contortion of slates and the subsequent development of slaty cleavage in Mariposa beds at Sutter Creek. The sketch is of an area 20 feet square.



SKETCH showing Relation of Strike of Formation to Wildman Shaft.

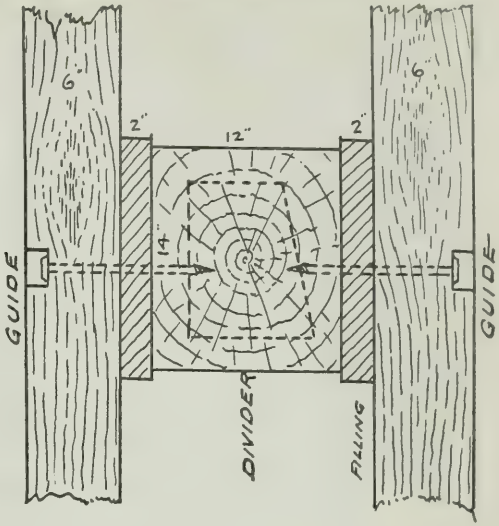
FIG. 21.

The Emerson Shaft.—The new, or Emerson, shaft, as it is called, is vertical, and is being sunk nearly 1000 feet east of the present Wildman inclined shaft. It is calculated that it will cut the Wildman vein at a depth of between 2300 and 2400 feet. It is difficult to give the exact depth, as through this section the lode flattens more or less in depth. It is now down over 700 feet. The ground passed through is diabase and diabase tuff, with some very hard gray slate (altered diabase), an occasional seam of black slate and stringers of barren quartz. The excavation outside of timbers is 8 x 20 feet, and is made across the stratification of the country—that is, the length of the shaft is east and west. (See Fig. 21.) Timbers used are all selected spruce, 12 x 14 inches, framed in the usual Comstock style, with the following exceptions:

First, the wall-plates are placed with the 12-inch side vertical, and the dividers with the 14-inch side vertical. A dap is cut $\frac{1}{2}$ inch deep in the wall-plate, top and bottom, for the center posts, which leaves $1\frac{1}{2}$-inch footing and heading for the posts, as the 14-inch side or end of the divider comes against wall-plate and posts, thus giving more strength

to the wall-plate and a better footing for the posts than would be the case if the divider were of the same width as the wall-plate.

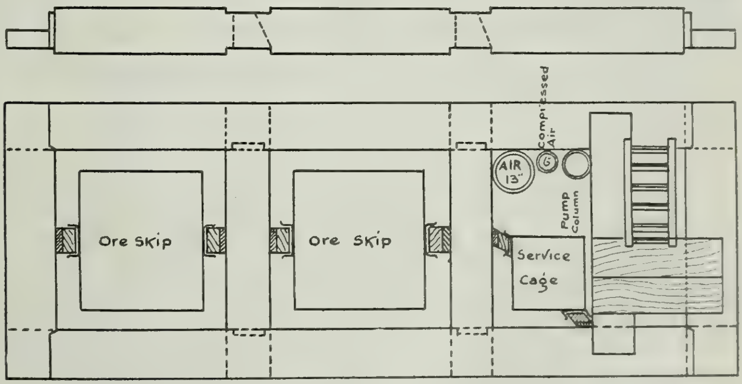
Second, as seen in sketch of divider (see Fig. 22), a 2-inch filling piece is inserted behind each guide, which gives 4 inches to work on (in keeping guides true) in case of a squeeze in the shaft.



SECTION OF GUIDES AND DIVIDER
showing Filling Piece - Wildman Shaft.

FIG. 22.

The sketch of section of shaft (Fig. 23) shows a small "service cage" in the pump compartment for the use of foreman and pumpmen. It is to be run open on two sides, to facilitate the handling of long lengths of pipe. All of the pipes are set on the side of the shaft opposite this cage. The ladders are each 15 feet long, inclined over each other, there being a landing at the end of each ladder. The shaft sets are 4 feet apart, or 5 feet from center to center of wall-plates. The skip compartments are



ARRANGEMENT OF TIMBERS - WILDMAN SHAFT.

FIG. 23.

$4\frac{1}{2}$ x $4\frac{1}{2}$ feet, and the pump and ladder compartments $4\frac{1}{2}$ x 5 feet. The wall-plates and ends of dividers are so framed that the dividers are driven up into place instead of down, which prevents their being knocked out by blasts.

It is the intention to use skips that will carry 3 tons of ore at a load, making total weight of load (including cable and skip), starting at a depth of 2500 feet, about 6 tons. Foundations of stone and cement for permanent headgear have been built from bedrock to the level of the collar of the shaft. The temporary hoist and gallows frame now in use

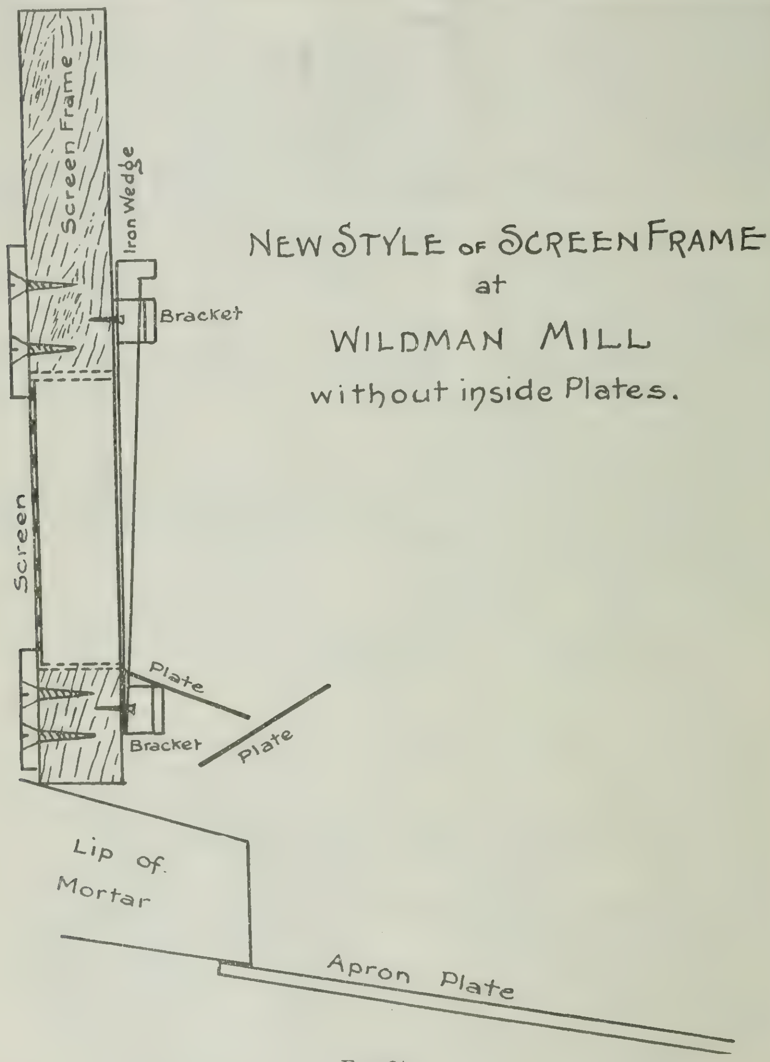


FIG. 24.

at this shaft is so constructed and arranged that the permanent steel head frame can be erected over the shaft without interfering with the progress of work. The design of the proposed steel headgear is by E Chodsko, of San Francisco. If erected this year it will be the first of its kind in California.

The Wildman Mill.—The mills of the Wildman Company are operated with as great care as any in the State, and merit a detailed description. There are two mills, each of 40 stamps. In the Wildman mill the stamps weigh 850 pounds; these drop from 7 to 9 inches 96 times per minute; the guides are of iron; the height of discharge is $7\frac{1}{2}$ inches, regulated by chuck-blocks, having a difference of $\frac{1}{2}$ to 2 inches in height. A No. 2 punched tin screen is used. The capacity of the mill had been about 145 tons per day under the above conditions, but the height of discharge has been lowered not to exceed 6 inches for the purpose of experimentation. This will have a tendency to increase the capacity of the mill. The outside plates have a grade of $1\frac{1}{2}$ inches to the foot.

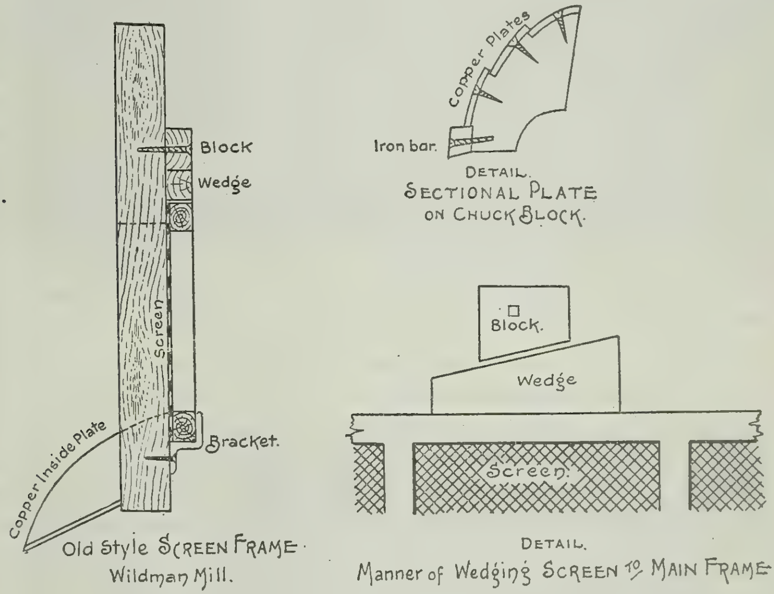


FIG. 25.

There are 14 Frue vanners and 2 Triumph concentrators in use. The ore contains about $1\frac{7}{10}$ per cent sulphurets, which are shipped to Selby's. They formerly used 11x48 inch No. 24 Russian iron and cold rolled steel screens, diagonal slot. Of these the steel screens proved the most durable. They now use a No. 2 punched tin screen having 225 holes to the square inch. These apertures have a slightly greater diameter than the slot of the No. 24 screen. Formerly the screen was secured flush with the outside of the frame, which was provided with an inside plate. The screen frames are now arranged as shown in the accompanying drawing (Fig. 24). The former method is shown in Fig. 25.

The Hector or Mahoney Mill.—In this mill there are 40 stamps, which weigh 950 pounds. The height of the drop is from 7 to 9 inches 96 times

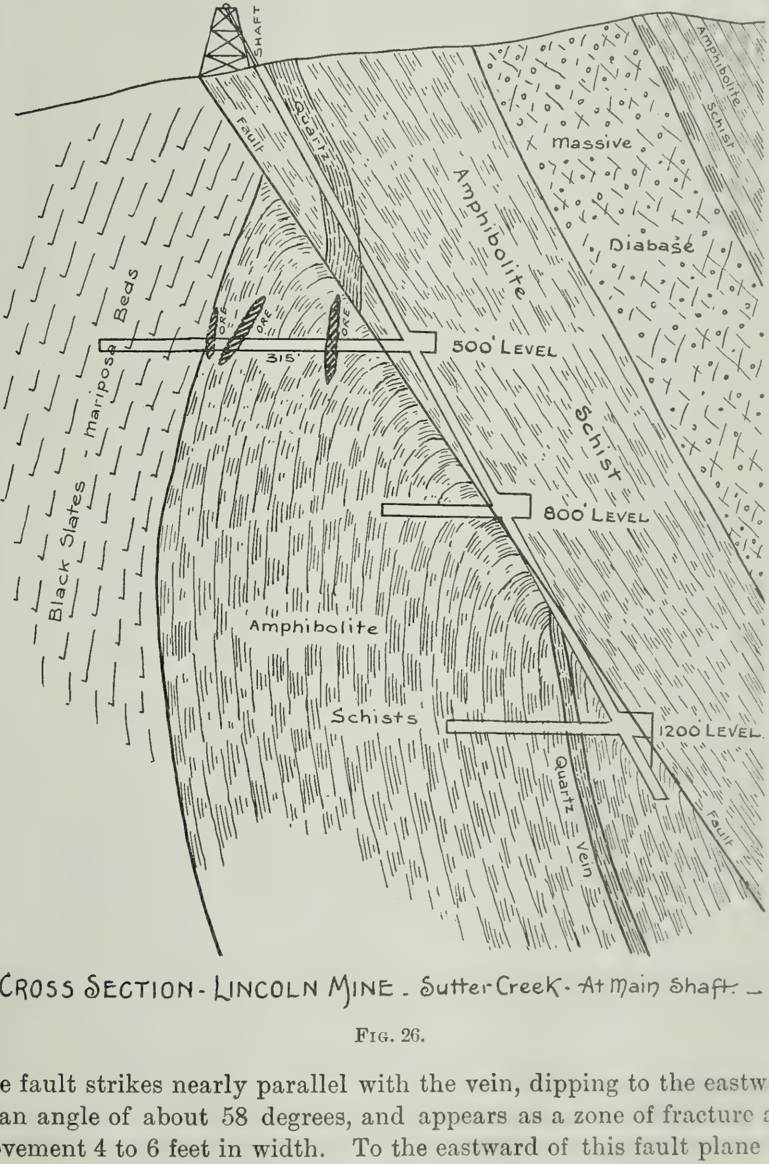
a minute. The height of discharge was formerly 6½ inches, but is now from 3½ to 4 inches, being adjusted by differential chuck-blocks. The Globe Iron Works guides are in use. A No. 2 punched tin screen is used, the capacity being 146 tons per day. Chrome-steel shoes and dies having 8½ inches diameter are used. There are 16 Frue vanners in the mill which concentrate the sulphides, these constituting $1\frac{9}{10}$ per cent of the rock. In the Hector mill the pulp falls from the batteries onto a 4-inch plate and drops to a second plate pitching backward, falling on the lip of the mortar below, in front of which is a 5-inch plate with a ¾-inch drop to the first apron plate 28 inches wide. The inside plates have been taken from the mortars and every effort made to increase the capacity of the mill, while giving the most careful attention to outside amalgamation. Below the first apron plate, the pulp falls into a trough 3 inches wide and 4½ inches deep, discharging through ten 1-inch auger holes, then to a 3-inch board and onto plates 24 inches square, arranged in double parallel series. The pulp passes by two drops to two other sets of plates, at the foot of which is a mercury trap. Below the trap are sluice plates with three drops of 2 inches each. These plates are 12 feet long, at the lower end of which a second trap is arranged, from which the pulp goes to the vanners. 165 men are employed in the mines and mills.——The Wildman Gold Mining Company, owners. John Ross, Jr., of Sutter Creek, superintendent.

Lincoln Mine.—It is at Sutter Creek. This property was worked in early days, a shaft being sunk 807 feet. To a depth of 350 feet, or thereabouts, it is said that the mine paid handsomely. At that depth a fault intersected the vein and all trace of it was lost. The present company re-opened the mine in the latter part of 1898. The old shaft was repaired, the workings cleaned out, and sinking resumed in February, 1899. The shaft is now 1260 feet in depth. On the 500-foot level a drift has been extended several hundred feet, and a cross-cut run both east and west about 200 feet north of the shaft. That portion east of the main gangway is in tufaceous slate and diabase, and that to the westward passes through the black tufaceous slates, and then through a broad zone of hard, amphibolite schist, to the black clay slates of the Mariposa beds 315 feet west of the gangway. In this cross-cut are exposed three ore veins, one of which has been drifted for a distance of 168 feet. This vein is 110 feet west of the gangway. A second vein is encountered 135 feet farther west. This vein is from 6 to 20 feet wide, and carries a satisfactory grade of pay rock consisting of quartz and amphibolite schist with disseminated auriferous iron sulphide and free gold. It has been developed by a drift 200 feet long. The third vein lies about 70 feet to the westward of the last-mentioned vein, near the contact of the amphibolite schist and the clay slate of the Mariposa beds. It has not been developed as yet. As there appeared to be

Lincoln Mine, Sutter Creek, Amador County.

The Bunker Hill Mine, Amador County.

some doubt as to what had occurred at the 350-foot level, when the mine was formerly operated, a careful examination of an old abandoned level extending from the shaft at 400 feet from the surface was made by Superintendent Voorheis and the writer. An investigation at this point discovered the fact that a fault fissure had dislocated the vein.



CROSS SECTION - LINCOLN MINE - Sutter Creek - At Main Shaft -

FIG. 26.

The fault strikes nearly parallel with the vein, dipping to the eastward at an angle of about 58 degrees, and appears as a zone of fracture and movement 4 to 6 feet in width. To the eastward of this fault plane the schists and slates and the vein itself all have an easterly dip. Underneath the fault plane, however, the entire country—schists, greenstones,

slates, and veins—dips strongly to the westward. In the west cross-cut north of the shaft on the 500-foot level, and in a west cross-cut south of the shaft on the same level, this condition is clearly in evidence. A cross-cut run westerly from the shaft at the 650-foot level shows the formation to be still pitching to the westward, though in a cross-cut at the 800-foot level it is standing nearly vertical, and on the 1200-foot level the formation has assumed nearly its normal easterly dip in the neighborhood of the shaft. On this level, at the face of the cross-cut 275 feet west of the shaft, it has a slight westerly dip. These workings show that the entire formation lying to the westward of the fault plane has been contorted from its normal position, having a westerly instead of an easterly dip, although as depth is attained the formations appear to assume their normal positions. The sketch (Fig. 26) illustrates the structural features of the Lincoln Mine. All the evidence obtainable leads to the belief that the rich vein worked from the surface slipped downward along the fault plane, and that its further extension downward must be sought in the country lying to the westward of the shaft, and it is the belief of the writer that the cross-cuts on the 500-foot level have intersected the vein which was dislocated by the fault at the 350-foot level.

The mine is well equipped with steam hoist, air-compressors, machine shop, and other accessories, but has as yet no mill.

In recovering the old Lincoln shaft, the settling of the ground had forced the shaft out of line, which necessitated the removal of a large amount of ground from the hanging-wall side of the shaft. To keep it in alignment this space was timbered in square sets, the number of the sets varying with the distance from the shaft to the solid ground. This has not been found to give any trouble.

In swelling ground, such as is found in this mine and many others in this county, experience has demonstrated the advisability of cutting large stations and placing sets outside of the main station sets; lagging openly—leaving spaces 8 to 10 inches between the lagging, which preferably, should be light. These light lagging, under pressure from the swelling ground or from a squeeze, will bend and eventually break thus giving sufficient warning before material damage results to the main members of the set. The open spaces are useful in cutting out and removing the swelling ground, and the lagging may be removed if necessary, but the main timbers will only occasionally require resetting or renewing. There are 24 men employed.——The Lincoln Gold Mine Development Company of San Francisco, owners. E. C. Voorheis, superintendent.

Mutual Mine.—On the summit of the ridge between Sutter Creek and Amador City. A vertical shaft has been sunk on this property to a depth of 400 feet (March 1, 1900). Cross-cuts are being run to prospect

two veins, one of which lies in the black slate on the hanging-wall side of the shaft, and the other in greenstone schist on the foot-wall side. The hanging-wall vein has been reached and good ore found in a drift on the vein. In some surface workings very good ore was taken from the foot-wall vein. The mine has a substantial steam hoist, and is otherwise well equipped for prospecting. There are 15 men employed. ——Mutual Mining Company of San Francisco, owners. S. R. Porter of Sutter Creek, superintendent.

Baliol Mine.—This is 1 mile east of Sutter Creek, and comprises a number of claims on patented agricultural lands, and covers a series of veins in amphibolite schist. An inclined shaft has been sunk to a depth of 750 feet, with levels at 200, 300, 500, and 700 feet and stations at 400 and 600 feet. In a cross-cut run easterly from the shaft, a distance of 380 feet, four of the veins have been intersected; No. 1, the foot-wall vein, is cut at a distance of 110 feet from the shaft, and is about 12 feet wide; No. 2, 39 feet farther east, is from 7 to 17 feet wide; No. 3, 35 feet eastward, is 60 feet wide; and No. 4, 74 feet beyond the last, is 6 feet wide. Since February, 1900, a cross-cut east from the 500 station has discovered higher grade rock than any found in the veins above mentioned. All stoping is done by means of machine drills. The diamond drill has been used with good results in this property, bore holes driven to the eastward having cut good-sized bodies of ore some distance from the main development of the mine. A large amount of ore has been stoped from three large open cuts, all showing a similar character of ore. The large veins resemble, somewhat, those of the Utica-Stickle mines of Angels. The foot-wall is diabase tuff, slightly schistose. The hanging-wall is also of this character, but farther east are intrusions of granitic rock. A granular-dike rock of light-gray color, much silicified, and containing about 2½ per cent sulphurets, constitutes, together with vein-like masses of quartz, the principal ore-shoots in this mine. Occasionally copper sulphide and arsenical sulphide ores are found. The property is equipped with a 40-stamp mill, the stamps weighing 1100 pounds, dropping 5 inches 102 times a minute. No. 35 mesh punched tin screens are used, the discharge being from 4½ to 5 inches high. The capacity of the mill is 4½ tons per stamp. Chrome-steel shoes and cast-iron dies are in use; one shoe will outlast three dies, the life of the shoe being 112 days. Risdon vanners are used for concentration. There is no canvas plant. The plates are 60 inches by 24 feet, with a 1¾-inch drop. The apron plates are on carriages, and may be rolled away from the front of the battery when necessary to clean up. The plates are dressed as often as necessary—usually twice in 24 hours. The proportion of free gold is variable, constituting from 40 to 70 per cent of the values. The sulphurets are shipped to Selby's. The mill and air-compressor are run by water power. The hoist is operated by air, the compressor being located at the mill.

It has an automatic hydraulic governor, made at the Knight foundry of Sutter Creek. This maintains a pressure at 80 to 100 pounds. The compressor is driven by a water-wheel under 452 feet head. There are 100 men employed.——The Western Gold Mining Company, owners. W. H. Storms of Sutter Creek, superintendent.

Potazuba Mine.—It is situated 1½ miles east of Sutter Creek, adjoining the Baliol on the west. The shaft has been sunk to a depth of 500 feet on the vein, with a sump 40 feet, by means of a small steam hoist. Levels have been run at 100, 200, and 350 feet; the shaft and levels are on the vein, which varies from a few inches to 12 feet in thickness. The foot-wall portion of the ledge has proven very rich. At the Zeila, Wildman, and Baliol mills were made several runs of the rock from this foot-wall strip, which have produced about $15,000, averaging about $25 per ton, some of the ore running as high as $100 per ton. The hanging-wall portion of the vein is low grade. The mine is in the hands of a local company, which has spent $40,000 in its development. Heavier machinery will be required to sink to greater depth. At present the mine is idle from lack of funds to properly equip it, although it is expected to resume operations some time this year.——The Potazuba Company of Sutter Creek, owners. W. J. McGee of Sutter Creek, secretary.

Treadwell & Guliana Mine.—This is 8 miles east of the town of Sutter Creek. There are two veins in the property, on one of which, the Treadwell, there are two tunnels, one 700 feet, the other 300 feet in length; besides which there are numerous superficial cuts. The vein is from 1 foot to 12 feet wide, and has produced some high-grade ore. The Guliana vein was discovered in the bed of Sutter Creek, where it is 3 feet in width, showing free gold. There is a 30-foot shaft and a short tunnel on this vein. The mine is idle. The mill which was formerly on the property is dismantled. The mill contained 6 stamps, and was operated by water under 150-foot head with a 10-inch pipe-line. This did not apparently afford sufficient power to run the mill, and it was consequently shut down. Several years later, it is said, it was discovered that in some manner a piece of scantling had gotten into the pipe-line, descended by suction to the nozzle, clogging it, and reducing the power to the extent described.——M. D. Nixon et al. of Sutter Creek, owners.

Free American Mine.—This is 6 miles east of Sutter Creek, on a small vein of high-grade rock in Calaveras formation. In one place it is stated that the vein is 6 feet wide, and that the rock will run $25 per ton, and at the bottom of the shaft the vein is 8 feet wide in good milling ore. The shaft has been sunk to a depth of 110 feet near Sutter Creek, and a drift extended out under the creek along the vein, with the

result that the mine was flooded, the surface water probably coming directly from the creek. The property was provided with both water and steam hoist, a jackhead pump and a steam pump, both of which were operated as vigorously as the power would permit, in addition to bailing with the skip at the same time; but this combination failing to lower the water in the shaft, operations had to be abandoned. A light 10-stamp mill forms a portion of the equipment of the mine.——Wilfred Dennis of Sutter Creek, owner.

South Spring Hill Mine.—This property adjoins the Keystone on the south, and is in many respects similar to it geologically. After an idleness of about seven years, operations were resumed in June last, and at this writing (June 10th) the mill is about ready to start. It is said that good ore is being found at the north end of the mine.—South Spring Hill Mining Company, owners. John R. Tregloan of Amador City, superintendent.

South Keystone Consolidated Mine.—This is half a mile south of Amador City, adjoining the South Spring Hill. It is in the prospective stage.—J. A. McIntyre of Amador City, owner.

Keystone Mine.—This is at Amador City, and is one of the most extensively developed mines in the State. There are probably not less than 10 miles of underground workings in this famous old mine; but all work at present is confined to points above the 1000-foot level, although the shaft is 1575 feet in depth. The formation at the Keystone Mine consists of diabase tuff, tufaceous slates, and the clay slates of the Mariposa beds, the latter lying west of the principal veins. To the west of these clay slates, massive diabase is again found. The principal veins, however, are those occurring in the tufaceous slates. The main vein occurs along a fault plane, which has a variable dip from 35 to 65 degrees to the eastward and extending more than 2000 feet in a remarkably straight course. On the hanging-wall side of this fault plane occurs immense masses of diabase material and quartz, which in places is more than 100 feet in width. Considerable portions of this constitute payable ore, although there are large quantities which it will not pay to mine. This great, massive vein forms the hanging-wall of a banded slaty vein, which has produced a large amount of pay rock south of the main shaft. Between the 400 and 600 levels on this vein an immense stope covering a superficial area of 20,000 square feet has been cut, the vein in places being 25 feet in width. There are few timbers and but one or two pillars in this great stope, which has been open for years, which indicates how well this ground stands without artificial support. This is probably the largest open stope on the Gold Belt. This was being filled as rapidly as possible during my visit, in order that the large amount of ore known to lie in the overhanging (so called) wall may be mined

without danger. On the hanging-wall side of these veins is a greenstone formation several hundred feet in width, through which a crosscut has been run from a neighboring gulch. Sections cut for microscopic study (Nos. 10 and 11) prove this rock to be diabase tuff. Lying between this massive tuff and a broad zone of black tufaceous slate is a dike of crystalline, granular diabase of normal type. The tufaceous slates are from 400 to 600 feet in width, and constitute the zone of fissuring in which are found the several veins and ore-shoots of the Keystone Mine. The veins all intersect the inclosing rocks in strike and dip, the dip of the slates always being steeper than that of the veins, excepting where disturbed locally. The region of greatest disturbance is found in the western portion of this slate zone. The great quartz vein lying in the hanging-wall side of this zone is from 1 foot to more than 100 feet in width when measured at right angles to its dip. It is made up of great lenticular masses of quartz and brecciated quartz and diabase, having interior fissures or planes running nearly parallel with the strike of the vein. These are usually referred to as walls. Some of these masses are built up by the splicing of the lenses. On the 800-foot level, and a few feet distant in the east wall of this vein, is an interesting though small vein in a reef of pyritic, black tufaceous slate. Through the center of this reef is found a small irregular vein of quartz, with a small gouge and with numerous flat branching seams. The occurrence of arsenical iron sulphides is a marked and persistent feature of this little vein, but a more interesting feature is the occurrence of pockets of gold, ranging in value from a few cents to over a hundred thousand dollars. The latter was obtained between the 800 and 900 levels. Within the past year, Mr. W. A. Prichard, the superintendent, has discovered a number of good-sized gold pockets in this vein. On the 800-foot level a dike of diabase intervenes between the great massive vein and the pocket vein above described, while on the 900-foot level, about 200 feet farther north, the diabase and reef of pyritic slate are passed through before the great vein is encountered. Arsenical sulphide was also discovered on the 900-foot level, in this vicinity. Although no pockets have been found on the 900-foot level, or below it, the indications are that the pocket vein is older than the great vein cutting across it, and that the pocket shoot may be found from the 900-foot level downward in the foot-wall of the great vein. In the large vein are found the widest stopes in the mine. West of this are two veins, separated from each other and the great vein by varying widths of tufaceous slates. These veins were also extensively worked in former years.

A careful and detailed study of the Keystone Mine would undoubtedly furnish material for a book much larger than the volume in which this description is found. There are 90 men employed in the mine and mill.

Keystone Consolidated Mining Company of San Francisco, owners. W. A. Prichard of Amador City, superintendent.

Keystone Mill.—The mill consists of 40 stamps, and two Griffin mills. The latter were formerly used in crushing the fine material from the mine, but are at present not in use. The mill is run by water power, and the hoist by steam. The mill is under the direction of C. E. Bunker. The stamps when new weigh 725 pounds. Prior to March 10, 1890, they were dropped 90 times a minute. A Pelton wheel was put in the mill at this time to run the concentrators independently, and the stamps were speeded to about 100 drops a minute, the height of the drop being from 7 to 7½ inches, and the discharge 7½ inches high. Nos. 6 and 7

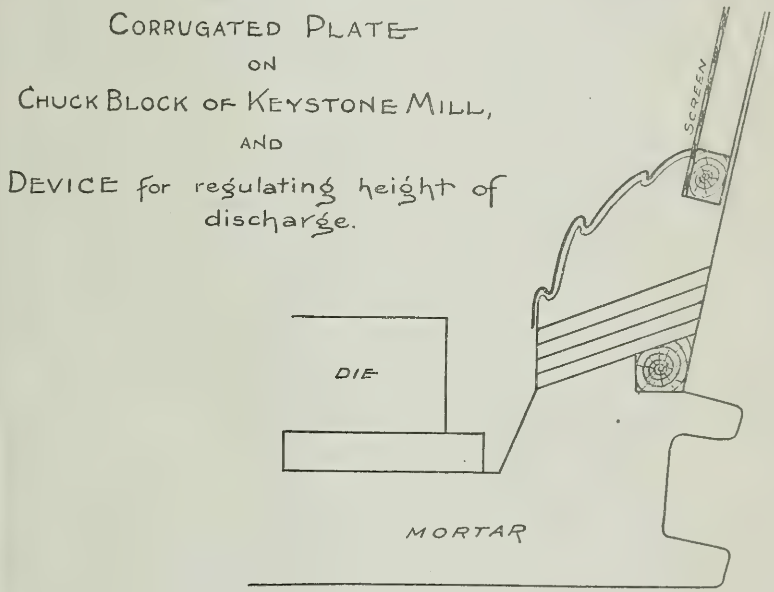


FIG. 27.

angle-slot steel screens are used. The chuck-blocks are arranged so as to drop half an inch at a time. A variety of shoes and dies have been tried here, including cast-iron, manganese, chrome, and hammered steel. The capacity of the mill per stamp is 2½ to 3 tons per day, varying somewhat with the character of the ore. This low capacity is probably attributable to the light-weight stamps. The inside plate is curved, and 6 inches in width. The apron plates are 52 inches wide and 4 feet long, having a grade of 1¼ inches in 12. Below this the plates are narrowed to 48 inches for a length of 10 feet, below which they are further narrowed to 30 inches and 24 inches long, with a trap at the bottom.

Since February 1, 1900, numerous changes have been made in this mill. On an experimental battery, the chuck-block has been changed

so as to reduce the width of the mortar 2 inches, by placing the screen flush with the main frame. The stamps have been speeded to 100 drops a minute; the discharge has been lowered, and closer attention is being given to outside amalgamation. The apron plate has been widened to 60 inches for a length of 16 feet, and the grade of these plates has been reduced to $1\frac{3}{4}$ inches per foot. No water is added outside the batteries, as in all the others, and the inside-battery water has been reduced to the lowest possible amount. The lowering of the discharge would probably have increased the capacity of the mill, but the decrease in the amount of battery water has a tendency to retard discharge. The capacity of this battery is about the same as that of the other batteries, but as a result of these changes, the tailings have shown a marked decrease in value, and it is the intention to adapt the entire mill to these changes. A new chuck-block with corrugated copper plate (see Fig. 27) has been introduced in this mill.

Bunker Hill Mine.—It is $1\frac{1}{2}$ miles north of Amador City. This property is a consolidation of the Bunker Hill and May Flower. On it is a shaft in the May Flower 350 feet in depth. The old shaft of the Bunker Hill was sunk to a depth of 800 feet; it had been closed for a number of years when it was re-opened in the latter part of 1899. The upper portion of the shaft was badly caved, which required a great deal of work to recover. A cross-cut tunnel was driven some years since near the base of the hill to connect with the old May Flower shaft at a station, and a branch driven beyond in the direction of the Bunker Hill. This latter has been continued to the Bunker Hill vein, it being the intention to drain the mine of surface water through this tunnel. There is also a shaft 400 feet deep on the south end of the property. The hanging-wall of the vein is a fine-grained grayish rock (No. 16), in places carrying considerable finely disseminated iron sulphide; this rock is diabase tuff, greatly altered. The slates found in the foot-wall are the result of alteration of tufaceous diabase, and bear the characteristic pitted marks which distinguish this class of slates in Amador.

In its early history, the Bunker Hill is credited with a production of about $1,000,000 down to the 700-foot level. The shoots have a southerly trend. The mine is equipped with a substantial steam hoist, but as yet has no mill. 20 men are employed.——The Bunker Hill Consolidated Mining Company, owners. C. R. Downs of Sutter Creek, superintendent.

Fremont Mine.—This property, $1\frac{1}{2}$ miles north of Amador City, comprises the Fremont, Gover, and Loyal Lode, 4200 feet on the lode. The principal work on this property is on the Gover Mine, the main shaft of which is down 1500 feet on an incline, being 1050 feet vertical. There are ten levels, and in the lower levels of the mine there are developed large masses of low-grade quartz. In the early part of the present year, a new shaft was started on the Fremont claim. This is an inclined

shaft, sunk at an angle of 51 degrees below the horizon. It is started in the hanging-wall of the vein, which it is calculated to intersect in depth. The close proximity of the old flooded works of the Gover will probably render the sinking of this new shaft a difficult if not dangerous operation; at least such has been the experience of others who have attempted to sink new shafts in the vicinity of old flooded workings.—— Gover Consolidated Gold Mining Company, 10 Market street, San Francisco, owners. C. E. Purington of Amador City, superintendent.

Phœnix Reduction Works (Chlorination).—This is at Drytown, and consists of a single reverberatory furnace, with all the essential vats, etc., for a complete plant of the Plattner type. (No barrel chlorination is practiced in this State.) The Drytown plant has a capacity of 3 tons daily, and treats custom ores only. There are 5 men employed. E. S. Barney of Drytown, owner and superintendent.

In the chlorination process as practiced in Amador County, the auriferous sulphides which are derived from the ores by the various methods of concentration, are charged in reverberatory furnaces usually containing about 10 per cent moisture. The charge is moved forward on the hearth every eight hours, and a new charge introduced. These furnaces are from 60 to 65 feet in length and from 11 to 14 feet wide. Pine wood is used for fuel, the quantity required per ton of sulphides being one fourth to one third of a cord. The charge of ore ranges from 2000 to 2500 pounds. Three charges are introduced every twenty-four hours. A "dead roast" is absolutely essential to a complete and successful extraction of the gold. Dampers are provided in the stacks, which are manipulated with the greatest care.

When the sulphides take fire, and following the volatilization of the arsenic, should any be present, but while sulphur still remains, salt is added. After the pulp has been withdrawn, it is allowed to cool and is dampened, the proper amount of moisture being determined by compressing a quantity in the hand. If it fails to crumble, it contains too much moisture; if it crumbles rapidly, the amount of moisture is insufficient; but when the compressed ball slowly disintegrates, it is considered to have the proper amount of moisture. The pulp is charged in vats by being shaken over screens, the charge being from 4 to 6 tons.

Chlorine gas is generated in lead-lined vessels, the following materials being employed: salt, 50 to 60 pounds; manganese dioxide, 30 to 40 pounds; sulphuric acid, added as long as gas is generated. When the vats have been charged with pulp, the gas is turned in, passing upward through the false bottom of the vat, penetrating the charge, and eventually reaching the surface. Tanks are gassed until it shows near the surface of the charge, which usually occurs in from three to five hours, when the cover is luted on. The gas is shut off when it appears on the

surface. This period is determined by holding a bottle of ammonia near a small vent in the cover. Upon the appearance of the chlorine gas through this vent, a dense cloud of chloride of ammonium at once forms. Water is introduced through a hole in the cover, falling on a burlap sack. It is a common practice to allow the water to stand from one to two hours, when it is turned into the precipitating tank. The water is permitted to run until the iron sulphate solution fails to show the presence of gold, samples being taken from the vat. If the assay of samples shows that high values remain in the pulp, it must be removed from the vats and "regassed." The leaching vats are provided with a double floor; these are made with slats 1½ inches in width placed 18 inches apart. Upon these and at right angles to the first are laid 1-inch boards 4 inches wide, covering the bottom; these are 2 inches apart. Upon this floor is placed a quantity of quartz gravel (clean creek gravel being preferred), usually laid in courses, to a depth of about 6 inches. Upon this filter are laid the shoveling boards, 4 inches wide and 1 inch in thickness, they being separated by a space of 1 inch. These spaces are filled in with fine gravel which will pass a No. 12 screen. . A solution of iron sulphate is employed to precipitate the gold from the chloride solution. The precipitate is washed and smelted with borax.

Centennial Mine.—This property is 1½ miles northeast of Drytown. An inclined shaft has been sunk 565 feet, and sinking was in progress in April last. This shaft, started on the vein, passes into the foot-wall, and cross-cuts are run to the vein at the 150, 250, and 350 levels. On the first the vein was found from 3 to 8 feet wide; on the second, 18 feet; and on the third, about 2 feet. The shaft will be continued to a depth of 1000 feet. The formation is greenstone schist (after diorite). ——Centennial Mining Company, owners. L. A. Gross of Drytown, superintendent.

The formation from the neighborhood of Drytown to Plymouth is largely amphibolite schist and diorite, tufaceous slates, and Mariposa clay slates. Many veins of quartz occur, both large and small, and also zones of amphibolite schist with quartz. There are many prospect holes of various depths throughout the region, but with the exception of those here mentioned, no operating mines.

Plymouth Consolidated Mine.—This property is at Plymouth, and has been idle for many years, but within the past year the old dumps have been worked with profit in Huntington mills. These dumps were estimated to contain over 250,000 tons of rock. The reduction plant consists of four 5-foot Huntington mills with hydraulic sizers, Wilfley and Woodbury concentrators, and canvas plant. Power is furnished by water from the Hayward ditch under a head of 572 feet. The dumps

were moved at very low cost by cutting in at their base and running an open cut directly into the end of the pile of rock. When a face of sufficient size had been exposed, a movable chute was placed against the face, by means of which all the rock above the level of the chute was easily delivered to cars beneath the chute. The rock was trammed to the mill, hoisted in the car by means of a hydraulic elevator, dumped onto the grizzlies, from which it passed to the rockbreakers, falling into a bin. From the bin, the rock was delivered to automatic feeders, thence to the mills.

Diagonal slot screens from 12 to 20 mesh are in use. From the mill the pulp flows to the sizers, from which the coarse material goes to the concentrating tables and the slimes to the canvas plant. The principal source of value in the dumps is in the sulphurets, which average about 1¾ per cent. The free gold is caught with the concentrates, which are shipped to Selby's. The following statement is made by the management relative to the cost of working:

Thirty Days' Milling, 3750 Tons.

Cost of delivering rock to mill	$375 00
Milling, including canvas plant	510 00
Water	240 00
General expense	110 00
Total	$1,235 00
Total cost per ton	32

——The New Western Mining and Reduction Company, owners. T. C. Woodworth of Plymouth, superintendent.

Pocahontas Mine.—This property is 1½ miles east of Drytown, and includes the Pocahontas, Edson, and California, the owners holding a bond on the Maryland claim adjacent. A vertical shaft has been sunk on the Pocahontas to the depth of 620 feet, with six levels. The formation is practically a black tufaceous, pitted slate, to the west of which lie the Mariposa clay slates. Over 1000 feet of cross-cuts have been run, extending from the Mariposa slates on the west to massive diabase on the east. The property is provided with a good steam hoist, and a 10-stamp mill run by water power. There are 6 men employed.——The Pocahontas Improvement Company of Drytown, owners. Allen McWayne of Drytown, superintendent.

Pioneer Mine.—It is 1 mile south of Plymouth, and comprises a mile on the lode, which consists of two veins; the east or hanging-wall vein of massive quartz, and the west vein banded structure. The latter is usually the better vein. These veins occur in the black tufaceous slates. An inclined shaft has been sunk 500 feet on the foot-wall vein, and in the several levels three shoots of ore have been developed. In some respects these shoots of ore are similar to those of the Central Eureka at Sutter Creek. The lower workings of the mine, however, are in low-grade ore, and appear to have reached a zone of little or no pay rock,

which seems to be a peculiar characteristic of many of the most important mines of Amador County. Geologically, the outlook for the future of the Pioneer Mine may be considered as encouraging, as there is no reason to anticipate that it may not at greater depth repeat the experience of the Kennedy and Argonaut, Central Eureka, and other mines in this county.——Dr. Thomas Boyson, owner.

Philadelphia Mine.—It is 4 miles north of Plymouth, near the Bay State. Several years ago this mine was opened by means of a large cut and drift, when operations were suspended, and the mine remained idle until the spring of 1900, when a new double-compartment shaft was started 1000 feet south of the old open cut. This shaft had reached a depth of 80 feet early in June. Its hanging-wall is diabase; the foot-wall is black slate. The vein formation is 20 feet in width. There are kidneys of good rock on the foot-wall side. The shaft is equipped with a water-power hoist, capable of going 1000 feet.——J. J. Crawford, Claus Spreckels Building, San Francisco, owner. Leased to J. R. Roaf et al. of Toronto, Canada.

Ivanhoe Mine.—It is 1½ miles northeast of Plymouth. The mine occurs in a zone of amphibolite schist, and is developed by a vertical shaft 130 feet deep, and also by an inclined shaft 120 feet. It has a 20-stamp mill and a steam hoist. It has been described in former reports, and was closed down in the spring of 1900.——Under bond to the Ivanhoe Gold Mining Company of Salt Lake. E. Brent of Sutter Creek, superintendent.

Shenandoah Mine.—It is 1½ miles northeasterly from Plymouth. This interesting vein adjoins the Red Cloud, described in former reports, on the south. The formation is diorite, which, near the vein, is altered to amphibolite schist. The shaft, early in May, had reached a depth of 375 feet, partly on the vein, but the lower portion in the foot-wall. Drifts were run at the 200 and 375 levels, the latter from a cross-cut. There are two veins in this fissure, one a massive vein of quartz, the other a banded or ribbon vein. On the south side of the shaft the banded vein lies on the hanging-wall side of the fissure, but on the north side it is found on the foot-wall side, being separated from the massive vein by a small gouge. The massive vein appears to be the older, it having been broken and crushed by the movement of the rocks. The banded portion of the vein, however, is quite regular, and shows no structural indication of disturbance. In addition to gold, there are found iron, lead, and copper sulphides. The shaft has been sunk between two shoots of ore, which have a southerly trend. The mine is equipped with a steam hoist, but has no mill. There are 12 men employed.——Shenandoah Mining Company of Sacramento, owners. S. K. Thornton of Plymouth, superintendent.

Red Cloud Mine.—It is 1½ miles northeast of Plymouth, adjoining the Shenandoah on the north. It has geological characteristics similar to those of the Shenandoah. It is idle. The shaft has been sunk to a depth of 365 feet, the upper portion of which was caved at the time of my visit. The surface croppings are exposed in cuts, and show two veins striking N. 13° W. and dipping 65 degrees to the east. The shaft appears to have been sunk at a point where a fault has displaced the vein, giving the appearance of two veins, whereas there is really but one.——The Red Cloud Mining Company of Stockton, owners.

Gowanus Mine.—It is 2 miles northeasterly from Plymouth. In this property there are several large lens-like masses of quartz striking through a much foliated amphibolite schist. These lenses have a width of from 1 to 8 feet, and occur across a zone of 150 feet or more in width. They appear to converge northward. The ore is granular, and of a dark blue color resembling some quartzite. It is said to mill $8 per ton. A three-compartment shaft (vertical) was being sunk during the spring of 1900, which was calculated to reach the vein at a depth of 200 feet. At this mine was found an unusual arrangement of a hoisting plant. The hoist, which is run by steam, is set opposite the end of the shaft instead of at the side. This was done with a view, it was explained, of leaving the ground for a permanent hoisting plant unobstructed, and of permitting the temporary plant to be operated until the new hoist could be placed in position. There are 8 men employed.——Gowanus Mining Company, owners. Mr. Rogers of Plymouth, superintendent.

Bay State Mine.—It is 4 miles north of Plymouth. There are several veins in this property. That known as the Bay State vein was formerly worked by the Bay State Company to a depth of 830 feet; it was stoped from the 400 to the 600 level. At the 750 level a cross-cut was run east to the vein and two shoots of ore developed, one dipping north, the other south. The north shoot is a banded vein, the south more massive and mixed with slaty material. The sulphides found in the south shoot were high-grade in gold. At 460 feet west, on the 750-foot level, a west vein was discovered in the cross-cut, which is called the Kretcher vein. This vein was observed at a point 346 feet west of the shaft on the 300-foot level. The Kretcher vein has been developed for a distance of about 300 feet, and consists of banded quartz of good grade. At the time of my visit some improvements were being made in the shaft, but the mine was not in full blast. The shaft will be sunk an additional 300 feet. The mine is equipped with a good hoist, and has a 10-stamp mill and an 8-drill air-compressor, all run by water. The pumping is done by air. The mill has a capacity of 40 to 50 tons daily. A 24-mesh punched tin screen is used. The pulp passes directly from the battery to the vanners, of which there are four. The tailings

are stated to contain but 21 cents per ton, chiefly in free gold. The sulphides are shipped to the Drytown chlorination works. There are 12 men employed.——The Globe Mining and Milling Company of Stockton, owners. J. L. Bryson of Plymouth, superintendent.

Rhetta Mine.—This mine is about 4 miles north of Plymouth, adjoining the Bay State on the south. It is developed by means of a cross-cut tunnel about 600 feet in length. There are two veins on the property. One occurs at the contact of a diabase foot and a black slate hanging; the other branches out from this contact vein, striking northward in the hanging-wall slates. Both of these veins have been explored with satisfactory results, the ore being hauled to the Bay State mill at a cost of 30 cents per ton. A large amount of water is encountered, but this causes little trouble, as it passes out through an adit tunnel. From the Rhetta vein southward in the direction of Plymouth, a line of springs marks the occurrence of fissures at or near the contact of the slates with the greenstone, and although this section affords a good field for prospecting, very little has been done toward exploring. There are 8 men employed.——Rhetta Gold Mining Company of Stockton, owners. J. L. Bryson of Plymouth, superintendent.

Talc Mines.—About 6 miles west of Sutter Creek is an interesting occurrence of gold in foliated talc schist, which appears to be a structural alteration of serpentine. On the Tonzi and Waechter ranches there are several zones of this talcose rock, in which the gold occurs in extremely thin plates in the foils of the rocks, much of which is thin as the finest gold leaf; while presenting the appearance of richness, gold of this character is very deceptive. On the Tonzi ranch, Mr. Tonzi has erected an ingenious device for crushing this ore, and claims to have taken out considerable gold at various times from the best selected gold-bearing material found on his place. That this gold-bearing talc can be profitably worked, is extremely doubtful; it is possible that if a zone of sufficient size, carrying $5 or more per ton in gold of the character described, could be found, it might be profitably treated by some modifications of the cyanide process.

Azula Mine.—This is 3½ miles northeast of Ione. It is a pocket mine in diabase, and has been worked with considerable success by its owners. Mining here is carried on in rather primitive fashion, but evidently with satisfactory results. The vein is from 16 to 18 inches in width, the small stringers going into the main fissure from the hanging-wall. Three men employed.——Adams, Burris & Smith of Ione, owners.

Nugget Mine.—This property is near the Azula, and is similar to it. It has a small steam hoist, and a 5-stamp mill has been constructed since my visit to the property; it was idle at that time.——Dr. Adams et al. of Ione, owners.

Queen Mine.—This is in the same group with the Azula and Nugget, and is geologically similar to the others. It has a small steam hoist.——Newman, Bagley & Frates of Ione, owners.

Ranlett Copper Mine.—It is located 3 miles northeast of Ione. The ore-bodies occur in the greenstone schists in which are found many of the copper mines in this State. The ore is that most common to copper mines in the West, and is amenable to treatment by various smelting methods. The development of the mine, while not extensive as compared with the great gold mines of the State, is sufficiently so to show that it is a mine of considerable possibilities. An examination of the mine and maps, together with the statement made by Colonel Ranlett, indicates about 30,000 tons of ore in sight, including that now on the dumps. The ore may be divided into two classes: a vein of solid, massive, yellow sulphide copper ore, distinctly separated from the adjoining rock, and in the foot-wall a zone of variable width, from 4 or 5 feet to 15 feet or more, in which occurs a large amount of iron sulphide, with a small percentage of copper sulphide. In this zone there are segregated bands of ore above the average of the zone in value, and which by rough sorting may afford a valuable product, though, of course, not so high a grade as that found in the massive vein. This ore contains considerable silica, and may become valuable as a flux in treating the more massive ore. The levels already opened are practically without cross-cuts; at least, such as have been made are not in ore, and others should be made in the foot-wall for the purpose of determining more fully the extent and value of the low-grade zone. Manila ropes are in use in this mine, steel ropes not having given satisfaction in former years; but I believe that as so many years have elapsed since steel ropes were employed here, it would be found that the modern steel rope would prove superior to the large, cumbersome Manila ropes now in use, even in the present old crooked shaft. I am positive that such would be the case in the proposed new shaft, which would be sunk at a uniform angle. A water-jacket smelter of 100 tons capacity daily was built at this mine during May and June, 1900. Not yet blown in, June 10, 1900.——H. G. Ranlett of Ranlett, superintendent.

EL DORADO COUNTY.

This county, which in past years has produced a very large amount of gold, is at present passing through a temporary period of inactivity, due partly to scarcity of water and to other causes not wholly apparent. There have been in the past in this county, and there are still, mines of undoubted merit, a statement abundantly proven by its history, and that the mines of El Dorado are exhausted cannot be entertained. Some large and extensively equipped enterprises have come into prominence and have been shut down since our last report, but the fact that there are those who have been led into unprofitable investment by reason of the exercise of too little caution should not, and probably will not, deter others from engaging in the legitimate pursuit of mining enterprises in this county on more conservative lines. No mining county in California, and no mining region on earth, is wholly free from these monuments of men's folly. It is a fact that in no county in California has mining been carried on at less expense than in some of the mines of El Dorado, and it still offers abundant legitimate and promising opportunities to those with both the capital and experience to handle large low-grade mines.

In passing northward from Amador County into El Dorado, the Central Gold Belt, or so-called Mother Lode, appears to split up. The geological conditions for a distance of five miles in El Dorado County are not wholly dissimilar from those of Amador, consisting essentially of massive outcrops of white quartz at or near the contact of slaty rocks and massive greenstones. These heavy outcrops of quartz are rarely gold-bearing in amount sufficient to constitute payable rock, and they are frequently accompanied, as elsewhere along the Gold Belt, by veins having a slaty structure, in which the gold contents are sufficiently high, in some cases at least, to afford profit.

When the neighborhood of the German Mine is reached, 5 miles north of the Cosumnes River, we find a new and strange intrusive rock—one with which we are not familiar in the region farther southward. A study of this region shows that in proceeding northward some of these rocks are of granitic type, ranging through grano-diorite and diorite to quartz-porphyry, and other porphyritic rocks. As we go farther northward, the rocks of this character increase in area, until in the neighborhood of Placerville they largely dominate all other kinds, although the rocks with which we are familiar farther southward (the greenstones) may still be found. On a prominent hill just north of the

Church Mine are large masses of rock of granitic type, of which a careful investigation was made. The granitic outcrop was found to be half a mile in width, striking with the general trend of the country in a northeasterly direction. On the eastward, large masses of diabase and amphibolite schist are found. A number of rock specimens were collected from various portions of this mass, and slides were prepared and studied by Mr. H. W. Fairbanks of Berkeley, whose report accompanies this bulletin. This investigation shows that specimens selected at any particular portion of the mass, and assumed to represent the entire intrusion, would be very misleading, for, in the several slides made from specimens taken from different portions of the hill, we find rocks of a decided acid character, and also those of basic kind, with many intermediate phases. (Nos. 30, 31, 32, and 33.) The specimens Nos. 26, 27, 28, and 29 are of similar rocks from Logtown and vicinity. In some, hornblende is abundant, and in others augite is a prominent constitutent; in still others, both of these bi-silicates appear. Some of the rocks have abundant free quartz, in others none is visible to the unaided eye. They also vary greatly in the kind and amount of feldspars they contain. Southward from this hill, in the direction of the German, Pocahontas, and Starlight mines, and the country about Logtown, are numerous intrusive dikes, large and small, of rocks of the above described characteristics, and in some of the masses rich gold-bearing deposits or veins have been discovered and worked, notably in the Pocahontas at Logtown. In the neighborhood of Placerville is found, near Diamond Springs, and extending northward beyond Placerville, another section of the great dolomitic vein which is characteristic of the Central Gold Belt in Calaveras, Tuolumne, and Mariposa Counties. Here is seen the same broad zone of dolomite, or ankerite, in which occurs an abundance of the beautiful, scaly, micaceous mineral, mariposite. Although the Pacific Mine in Placerville has been idle and inaccessible for many years, the old dumps clearly show the character of the geological formation. In this mine the ankerite has been compressed, sheared, and deformed, the original material being altered into a perfect talc schist. When this occurs, mariposite usually disappears, or, if present, cannot longer be detected by its characteristic green color. Serpentine also accompanies this belt, which is not an uncommon accompaniment southward. In the Pacific Mine, the serpentine is frequently found altered to a dark-green talc schist, which may be readily distinguished from the white schist resulting from the alteration of the dolomite.

The black slates found associated with the mineral veins between the Cosumnes River and Placerville are chiefly the result of the alteration of diabase tuffs, which has been described at length in the introductory paragraphs of this bulletin. Mariposa clay slates are also

found. Owing to the very unsettled state of the weather and the difficulties and delays attending transportation in March, the investigation of this section was not carried north of Placerville until the summer season.

German Mine.—It is 5 miles south of El Dorado. This was the first accessible developed mine going northward last spring in El Dorado County from Amador in which we find a material change in geological conditions. The general formation of the country consists, as it does farther southward, of massive diabase tuffs, amphibolite schists, and the clay slates of the Mariposa beds. Here we also find the black slates resulting from the alteration of the diabase tuffs which have been previously described as being intimately associated with the ore deposits of the principal mines of Amador County. The gold-bearing veins of the German Mine are found inclosed in these tufaceous slates, and the vein structure does not differ materially from the veins of Amador. The clay slates of the Mariposa beds lie both to the eastward and to the westward of the main fissure, but not in contact with it. The most striking geological feature of this mine is the intrusion of acidic dikes, which present various phases ranging from quartz-porphyry to granite. There were evidently several intrusions of different ages. These intruded dikes have been sheared and have suffered deformation in a manner similar to that characteristic of the altered diabase. These dikes in width vary from a few feet to more than a hundred feet, and in more than one place the larger dikes were found to contain zones of crushed material into which free silica has infiltrated, together with iron sulphides and gold, but to what extent the zones are gold-bearing has not as yet been determined. One intrusive mass which attracted my particular attention was found above the 100-foot level. It has been intruded from the southward into the slates, and, as viewed in the mine excavations, it looks like the stern of a great ship as it appears when lying in drydock. A banded, slaty vein follows around this peculiarly curved intrusion, having the granite on one wall and the slaty tuffs on the other. The mine is equipped with a water-power hoist and a mill of 10 stamps. The stamps weigh 950 pounds, and drop 6 inches, 100 times a minute. The discharge is 7 inches high, and a 30-mesh brass wire screen is used. This mill has a capacity of $3\frac{1}{4}$ tons per stamp. Below the battery plates, a shaking-riffle table has been introduced for the purpose of saving any amalgam escaping the plates. It is said to give satisfaction. A Wilfley concentrator is employed to concentrate the sulphurets, which constitute about $1\frac{1}{2}$ per cent of the ore. These are shipped to Selby's reduction works.——German Mining and Milling Company of San Francisco, owners. C. O. Richards of El Dorado, superintendent.

Buena Vista Mine.—It is 1 mile east of the German Mine, and 5 miles southerly from El Dorado. The veins are found in Calaveras formation—mica schist at this place. A small vein running parallel with the strike and dip of the schists has been followed for some distance in search of pockets, with satisfactory results. A former operator who prospected this mine, in some way was misled as to the value contained in a schistose zone impregnated with iron sulphides, and expended nearly $50,000 on the property, doing considerable development work, erecting numerous buildings, and a mill. The rock proved almost valueless, and the mine was closed. The present owners, however, are doing well.——C. O. Richards of El Dorado, owner. Grant Hill of El Dorado, lessee.

Last Chance Mine.—This vein is 1 mile east of Nashville, and is from 1 to 8 feet wide, occurring in the slates of the Calaveras formation. The vein has a beautiful ribbon structure, and has been developed by a tunnel driven on the vein. A light-colored dike accompanies the vein. The property is equipped with a 2-stamp mill run by gasoline engine. The property is idle.——A. C. Smith of Portland, Oregon, owner. H. E. Smith, in charge.

The Center Mine.—Owned by a New York company, and is near the Last Chance. Idle.

The Nashville Mine.—This mine is south of the Last Chance, and is equipped with a steam hoist. Idle.——E. J. Baldwin of San Francisco, owner.

Madelina Mine.—It is 5 miles south of Diamond Springs. This vein or zone is from 40 to 60 feet in width, in the Calaveras formation. There is a gouge and dike rock on the foot-wall. The ore is pyrrhotite, chalcopyrite, and pyrite with gold. The ore is extremely hard, and a great portion of it contains a very large percentage of the sulphides mentioned. It offers a problem in economic metallurgy. The vein is developed by means of a cross-cut tunnel 90 feet to the vein, and a drift along the foot-wall 100 feet, connected by a raise 105 feet to the surface.——Williams & Bier of El Dorado, owners.

Noonday Mine (Copper).—This property, near the Madelina, when visited, was simply a prospect having a 15-foot shaft and several open cuts on a 7-foot vein consisting chiefly of iron and copper sulphides, the latter ranging from a trace to 25 per cent. It may be considered a promising prospect.——Bonded to Dr. Procter of Placerville.

Montezuma Mine.—At Nashville. This property after an idleness was about to start up in the spring of 1900.——J. C. Heald of Nashville, owner.

Union Mine.—It is 3½ miles southeast of El Dorado. It was formerly known as the Springfield, and was operated by Alvinza Hayward to a depth of 1700 feet. Within the past two years the mine has been operated by a company, and a 30-stamp mill built. On another group of mines in the vicinity a new shaft was being sunk in March, 1900, and though less than 100 feet in depth, a 20-stamp mill was being erected. These properties are under the management of A. Harpending, and were the only ones visited during the season where inspection was denied and information refused. It was currently reported that a large amount of gold was being taken out, but I was unable to confirm this report. There are 45 men employed at these two mines.——A. Harpending of El Dorado, superintendent.

Church Mine.—It is located 8 miles south of Placerville, and 2½ miles from El Dorado. Three veins occur in the slates; they are well defined, and have hard walls and a gouge on both foot and hanging walls. The two veins mostly developed are of variable thickness, laminated, and carrying considerable sulphurets. There is also an east vein, known as the Union, which is being worked near the south end of the property on the adjoining Union Mine. Surface prospects on this lead in various places give a result of from \$2.35 to \$26 per ton. The vein worked by the former company was termed the Kidney vein, and has been worked to a depth of 1350 feet, taking out the best of the ore and leaving the low-grade ores. This vein averages 5½ feet in width, and the rock taken from it milled from \$28 to \$30 per ton. The prospective value of the mine is based on the value of the west vein, first discovered on the 350-foot level while sinking the shaft on the Kidney vein. There were milled from this ledge 3000 tons of ore taken from the various levels from the 350-foot to the 1200-foot level, which returned \$2.50 per ton free gold and about 2 per cent sulphurets, worth \$67 per ton; the tailings, owing to a lack of facilities in the mill, averaged \$1.27. This vein in many places is from 14 to 20 feet wide, averaging 8 to 10 feet. The main shaft is 1200 feet deep vertically, with a 40-foot sump, and has three compartments. Stations are cut at each level. The mine is equipped with a water-power hoist, and is provided with 3000 feet of steel cable. The compressor has a capacity of five 3-inch drills. The pumping plant, consisting of plunger and jack-head pumps, has a capacity of 150,000 gallons per day, which is about double the amount of water the mine makes. The mill has ten 950-pound stamps, four Frue concentrators, clean-up barrel, pans, etc. The machinery is run by water power taken from a reservoir owned by the company; at the mill there is a head of 485 feet.——Church Mine Development Company of San Francisco, owners. John Ross, Jr., of Sutter Creek, superintendent.

Griffith Mine.—It is half a mile southeast of Diamond Springs and half a mile from the Larkin Mine. Since the last report, this mine, at

that time a mere prospect, has been elaborately equipped with hoist, mill, etc., and an expensive electric power plant, by a Scotch syndicate. After a few months of active operation, the mine was closed down and nothing has since been done there. It is locally reported that it did not pay.——Griffith Mining Company of Glasgow, Scotland, owners. G. P. Gow of Stent, agent.

Larkin Mine.—One-half mile east of Diamond Springs. The great dolomitic vein passes through this property, in addition to which there are several other, though less prominent, veins. It is upon one of the latter, which occurs in the hanging-wall slates of the dolomitic vein, that operations are at present being conducted. This vein is accompanied by a small dike of diabase, and possesses the usual characteristics of veins in slate. The dolomitic vein is 80 feet in width, and is altered more or less to talc schist. The dolomite here appears to contain iron carbonate, and is properly ankerite rather than dolomite. The ankerite vein is also cut by dikes, a feature not observed elsewhere, and the foot-wall portion, for a width of several feet, is impregnated with quartz and pyrite, but no exploration had at the time of my visit been conducted on this mineral zone. There are several small veins in the amphibolite schist of the foot-wall, but these, too, remain unexplored. This mine has a 10-stamp mill, the stamps weighing 1000 pounds, dropping 110 times a minute. A No. 1 punched tin screen is employed. The discharge is 9 inches high, and the capacity of the mill under these conditions is said to be a little in excess of 3 tons per stamp per day of twenty-four hours. The ore contains 1½ per cent of pyrites. These have been shipped to Selby's, but experiments with the cyanide process have demonstrated that the gold can be extracted from the sulphides by this means without preliminary roasting or other treatment. Of the gold obtained by amalgamation, about 55 per cent is recovered in the battery.

An ingenious experiment has been tried by the superintendent with a view to prevent scouring of the inside copper plates. This consists of a cast-iron plate having the shape of a segment of a cylinder to fit the copper plate. It is ½ inch in thickness, with slots ½ inch in width and 20 inches in length. Within these slots the amalgam accumulates and remains. Concentration is accomplished on a single Wilfley table. A vertical shaft has been sunk 600 feet, and a cage is in use. There are 35 men employed.——Larkin Mining Company of San Francisco, owners. G. B. Jacobs of Diamond Springs, superintendent.

Selby Mine.—It is 1 mile east of Diamond Springs, near the Larkin Mine. Idle.

Marguerite Mine.—It is 1 mile east of Diamond Springs, near the Larkin Mine. Idle.

Tin Cup and Ribbon Rock Mines.—These mines are 2 miles south of Placerville, and are being operated under bond by A. Hayward of San Francisco. When visited, the main shaft was down 100 feet in "ribbon quartz" 5 feet wide showing gold, and for amount of work done it was considered the best prospect in that section of the country. There are 10 men employed. Since writing the above the shaft has been sunk to 200 feet and a heavier hoist installed.——E. A. Davis of Placerville, superintendent.

Gentle Annie Mine.—It is 1 mile north of Placerville. This comprises a property 1000 feet by 1700 feet, covering five parallel veins, of which the principal one appears to be the dolomitic vein, which has been previously described as characteristic of some portions of the Gold Belt. The mine, while extensively developed and equipped with a 10-stamp mill, has been idle since October, 1899, awaiting adjustment of the affairs of the Melton estate. There are two large air-compressors and a hoist, which may be operated by either water, air, or steam.——B. G. Parlow of Placerville, superintendent.

Revera Mine.—On Texas Hill, 3 miles east of Placerville. This is a drift mine, to which a bedrock tunnel was being driven 900 feet to the channel, which, on March 15th, had penetrated a distance of 600 feet. The property is equipped with a mill having a Dodge pulverizer with a capacity of 125 tons daily, running 15 revolutions a minute; there is also in the mill a Krough shaking-riffle. The mill is run by water power under 169 feet head. A self-discharging tank was a feature of the works, so arranged as to sluice out accumulated tailings. Since writing the above the tunnel has reached the channel, and is reported to be in pay gravel. Parker Bros. of Placerville, owners. C. L. Parker, superintendent.

Ellen Taylor Drift Mine.—It is 4 miles west of Indian Diggings. Sluicing and piping were in progress in the spring of 1900. There were 11 men employed.——A. B. Spreckels et al. of San Francisco, owners. F. J. R. Dawson, superintendent.

Umatilla Drift Mine.—This is in El Dorado County, 12 miles northeast of Plymouth, Amador County. The mine has been worked steadily for the past two years. The gravel channel varies greatly in width, and ranges from a few inches to 4 feet in thickness. The gravel is crushed in a Krough hexagonal mill, similar to the Dodge pulverizer, and has a capacity of 250 tons per day. Below this machine is a shaking-riffle, in which the gold is caught. The machinery is operated by water power.——Umatilla Mining Company of San Francisco, owners. C. O. Richards of Ono, superintendent.

Placerville Slate Quarry.—It is 1½ miles north of Placerville. Here a quarry has been opened upon a reef of slate 150 feet or more in width,

standing nearly vertical. A large portion of this slate appears to be of merchantable quality. The slate, after having been prepared for market, is hoisted to the top of the hill on an inclined tramway, the car being run from the quarry track directly upon the car or giraffe. The tramway is double. On the opposite track from the giraffe is a car carrying a steel cylinder with a capacity of several hundred gallons. This is filled with water at the top of the incline, and when its weight overbalances the weight of the giraffe, carload of slate, and cable, it moves downward, hauling the car up the incline, its speed being controlled by a brake at the head of the tramway. The water cylinder discharges automatically at the foot of the incline, when the giraffe and car return to their places at the loading station. This company has taken contracts to furnish slate for the buildings of the Mountain Copper Company at Keswick, Cal.; for the Government, and elsewhere. There are 10 men employed.——Placerville Slate Company, owners. G. W. Cummings of Placerville, manager.

Pocahontas Mine.—It is 3 miles south of El Dorado. The vein, which lies at a low angle with a curving strike, occurs in a feldspathic porphyry (No. 26), through which is scattered many crystals of bronze-colored mica. This peculiar rock when examined in sections under the microscope is seen to be a diorite-porphyrite. The property was at one time well equipped with machinery, having hoisting works and a 10-stamp mill, but these have been removed and the mine has been idle for some time, although at one time producing handsomely.——Q. A. Chase of San Francisco, owner.

Minnehaha Mine.—This is 3 miles south of El Dorado P. O., near Logtown. The vein occurs in quartz-porphyry much silicified, and containing a small amount of iron sulphide with coarse free gold. The vein strikes N. W. and dips N. E. about 10 degrees below the horizon. There is no parting between the vein and the country rock, the ore passing over gradually to the country rock. In one place along the surface in the hanging-wall was found a zone of porphyry with many quartz seams carrying gold. These were dipping toward the flat vein, but had not been reached in the mine workings. The rock is crushed in a 4-stamp mill. No concentrators were in use; 8 men employed.——Minnehaha Gold Mining Company of San Francisco, owner. Froehlich & Perham of El Dorado, lessees.

Starlight Mine.—Three miles south of El Dorado. The ore in this mine occurs in large lenses in a much altered, silicified diabase. There are several shafts on the mine provided with steam hoists, and there is a 10-stamp steam mill, which is supplied with ore from the several shafts by means of a rope tramway, having a capacity of 35 tons a day. The ten stamps weigh 1000 pounds each, and drop 6 inches 100 times a

minute. The discharge is $7\frac{1}{2}$ inches high. A No. 8 vertical-slot screen is employed. Concentration is effected by the use of two Union machines and a canvas plant. The ore contains 2 per cent of sulphurets—pyrite, galena, and arsenical sulphide. The value, however, is chiefly in free gold.——Starlight Gold Mining Company of San Francisco, owners. J. A. Vance of El Dorado, superintendent.

Oro Fino Mine.—This property, which has been repeatedly described in former reports, was found working as usual. It is situated 5 miles south of Diamond Springs. The vein, which is 40 feet wide, consists of a dike-like mass of diabase breccia which has become silicified and impregnated with finely disseminated auriferous pyrite. Many small seams of calcite traverse the rock in every direction. Both hanging and foot-wall country are diabase, but little altered even in close proximity to the vein. The vein material is extremely hard, and all ground is broken by machine drills, No. 1 Judson powder being used. A vertical shaft has been sunk to a depth of 200 feet, where it turns at an angle of 40 degrees and continues to a depth of 540 feet on the vein. The hoist is operated by compressed air. The mine has a mill of 30 stamps, which weigh, when newly shod, 1250 pounds. These drop 7 inches 105 times a minute. A 40-mesh punched tin screen is used, the capacity of the mill being 85 tons daily. No amalgamation is attempted inside the batteries. About one third of the values are in free gold, which is collected on the outside plates. The sulphides are concentrated on belt machines, and are treated in a chlorination plant owned by the company. Its daily capacity is 4 tons. A rotary conical breaker of the Gates type, being cast extremely heavy, has been found satisfactory in crushing this unusually hard rock. This mine has recently been shut down.——Hayward & Lane of San Francisco, owners. E. T. Kane of Canyon P. O., superintendent.

Vandalia Mine.—This interesting mine is situated about half a mile northerly from the Oro Fino. It has come into renewed prominence since the publication of the last report. In many respects it is entirely unlike others of the Gold Belt, though mines of somewhat similar character are known in Arizona, Nevada, and other portions of the Great Basin country. A description of the old Vandalia Mine will be found in the VIIIth report of the State Mineralogist. When being worked at that time, the ore was considered free milling, but still so large a percentage of the values was lost in tailings that the character of the mine was essentially the same then as now, though richer. The large ore-shoots developed by the present owners are not amenable to amalgamation, but the cyanide process, which has been applied in a rather rudimentary manner, has been found to operate satisfactorily.

When the present owners first visited the property, they tested the old tailings dumps which resulted from the operations of former owners,

and these were found to contain upward of $15 per ton in gold. A series of cyanide experiments soon demonstrated the adaptability of this ore to that process. The tailings dumps were first worked, and paid handsomely. Then the ore-bodies were attacked, and work has continued uninterruptedly since.

The ore deposits are found in a highly silicious felsite, having a semi-schistose structure, and in many respects are not unlike the quartz schists found in the Calaveras formation, though these latter are generally metamorphosed sandstones, and not of intrusive origin. The ore-shoots average over 80 feet in width and 300 feet in length, and cut both the strike and dip of the inclosing formation. The normal ore is essentially the quartz schist above described, heavily impregnated with iron sulphide, the oxidation of which has produced a mineralized zone extending from the surface to a depth of 100 feet or more, forming a reddish-brown iron cap or gossan. These ore-shoots are reached through adit tunnels, the lowest of which will, when extended, cut the ore-bodies 300 feet below their apex, and tunnels may be run at still lower points. The ore for most part, though heavily mineralized and oxidized near the surface, does not prospect at all in free gold, but always assays.

The mill found in operation at this mine was of home construction, made by the owners themselves, and is a rude, though ingenious affair, but not well suited to the class of work it is required to perform. It consists essentially of a revolving hollow cylinder resting upon four wheels or carriers, and provided with iron bars arranged transversely to its length, having about ½ inch space between them, similar to the Dodge pulverizer. In the interior of this cylinder are three so-called cams, which are really elevated ribs extending lengthwise of the cylinder and distributed at equal distances. The crushing device consists of three cylinders of iron, each 10 inches in length and 8 inches in diameter. These are connected at their ends by links, iron rods extending outwardly from each end of the connected cylinders to posts situated outside the machine. As the cylinder revolves, the cams, each in turn, lift the linked crushers until, clearing themselves, they fall backward a few inches, crushing the soft ore; this being repeated as long as the machine is in operation. The rock is fed through the open end of the cylinder, passing out between the bars, when crushed fine enough to pass the half-inch space between them. The machine is driven by a belt, power being furnished by a gasoline engine. As a result of this very coarse crushing, extraction of gold rarely exceeds 60 per cent.

The cyanide plant is situated about 200 feet from the mill, at the foot of an inclined tramway. The plant consists of two clear-water tanks, two stock-solution tanks, six percolation vats of 10 tons capacity each, two gold-solution tanks, and two sump tanks, together with the necessary precipitation boxes. The ore from the mill is delivered to the

cyanide plant by cars running on a double tram, the cars working in balance. Between the line of percolation tanks is a track running the full length of the plant, with a turntable at the center. The ore is dumped directly into the tanks, and distributed by shoveling at a cost of 25 cents per ton, including the cost of tramming. The cyanide solution is worked at about 0.25 per cent, with a consumption of 15 per cent cyanide. The ore is charged as described, and the solution turned in on top of the charge upon burlaps. It is allowed to stand three hours, when a valve is opened, and a pump connected with the weak solution in the sump tanks is started. This solution is pumped on at a rate equaling the progress of leaching, until the amount of solution charged is equal to the weight of the ore. The percolation process is usually completed in forty-eight hours. In the bottom of the precipitating-box an ordinary punched tin mill screen is placed, which keeps perfectly clean and shows no sign of corrosion. The cost of treatment is stated by the owners to be 50 cents per ton.——Seymour & Staver, owners and managers, Shingle Springs P. O. It is stated that this mine has recently passed into other hands, and is to be extensively equipped and operated.

Fortuna Mine.—It is 5½ miles south of Shingle Springs, near the Oro Fino Mine. At the time of my visit last spring, the mine and 5-stamp mill were idle, but the owners were building a ditch in anticipation of resuming operations.——Hale & Boughman of Canyon P. O., owners.

Monitor Mine.—It is 3 miles south of Canyon P. O. The vein occurs at contact of slate and greenstone. It has a shaft 60 feet deep, with a 50-foot drift at the bottom. The vein is 7 feet wide, and the rock is said to mill $6 per ton. The mine is provided with a steam hoist.——C. E. Schenks of Canyon P. O., owner.

Spanish Dry Diggings.—At this place, ½ mile northwest of Greenwood, a few men are making a living working the rich seams. No organized operations are in progress.

Altman Mine.—Near Greenwood. The property comprises 3000 feet on the lode. The principal development consists of a tunnel 500 feet long, which gives 250 feet backs. The mineralized zone is about 100 feet wide, and is stated to mill $3 per ton. A strip along the foot-wall, however, runs much higher. A 10-stamp mill formerly on the property burned. Two men are at work——John Smith of Greenwood, owner.

Gopher-Boulder Mine.—It is 1 mile north of Kelsey. The property was well equipped with electric power, but the generator house on Rock Creek burned. This is to be replaced. The mill contains 20 stamps and two 5-foot Huntington mills; these latter are stated to be equal to the 20 stamps in capacity. The vein is from 30 to 100 feet wide, but low-grade. A shaft has been sunk on the vein 250 feet, and a large open cut has been made in a zone of quartz and greenstone schist. Mining can

be carried on here very cheaply, as the company owns its power. At the Dalmatia, a mile distant, mining and milling were formerly carried on at a cost below 50 cents per ton. The Gopher-Boulder is idle, but it was stated that work would, in all probability, soon be resumed.——W. A. Bell of San Francisco, owner. W. H. Husband of Kelsey, manager.

Hayward Hydraulic Mine.—At Indian Diggings, on an ancient channel. There is about 150 feet of gravel, overlaid by over 100 feet of volcanic ash. The mine was extensively worked during the spring and summer seasons by hydraulic methods. About 1000 inches of water is employed in washing.——Plymouth Consolidated Mining Company, owners.

Eureka (*Strale*) *Slate Quarry.*—This property, situated near the village of Kelsey, was in operation during the summer, employing 20 men. Steam-operated power drills are in use. A superior quality of slate is produced at this quarry.——Eureka Slate Company, owner. W. A. Winsboro of Kelsey, superintendent.

Zantgraf Mine.—It is 7½ miles east of Newcastle, Placer County, and has been in operation for fifteen years. The principal shaft is sunk at an angle of 45 degrees in grano-diorite. It is 1125 feet deep. There are 10 levels open in the mine. Power drills are employed. Two shoots of good ore are on the main fissure, with 300 feet of low-grade rock intervening. On the 300-foot level a cross-cut, run 150 feet west, encountered a parallel vein, in which a shoot of pay rock has been developed. The sulphides, constituting ½ of 1 per cent, are high-grade, and with increasing depth it is stated that the percentage of sulphurets increases without any noticeable decrease in free gold. The north shoot on the main vein has been explored for a distance of 300 feet, and the face is still in good ore. The same shoot is being opened on the 300-foot level, where it is 600 feet long, and is also being developed on the 700 and 800 levels. On the 1100-foot level the shaft is in low-grade rock, but the north shoot is expected at the 1200, as it is pitching south. It is 150 feet from the shaft to the south shoot. The property is equipped with 25-stamp mill, and has a duplicate steam plant for both hoist and mill, though depending, under ordinary conditions, upon electric power. The company owns its power plant, which is located on the American River half a mile distant from the mine. The machinery was being renewed the past summer at the time of my visit. The stamps in the mill weigh 1035 pounds, when new. A punched tin screen is in use; the capacity is about 5 tons per stamp, with a discharge 5 to 6 inches high. This large capacity is due, of course, to the unusually coarse screen.——Montauk Gold Mining Company of New York, owners. Edward Goodwin of Newcastle, superintendent.

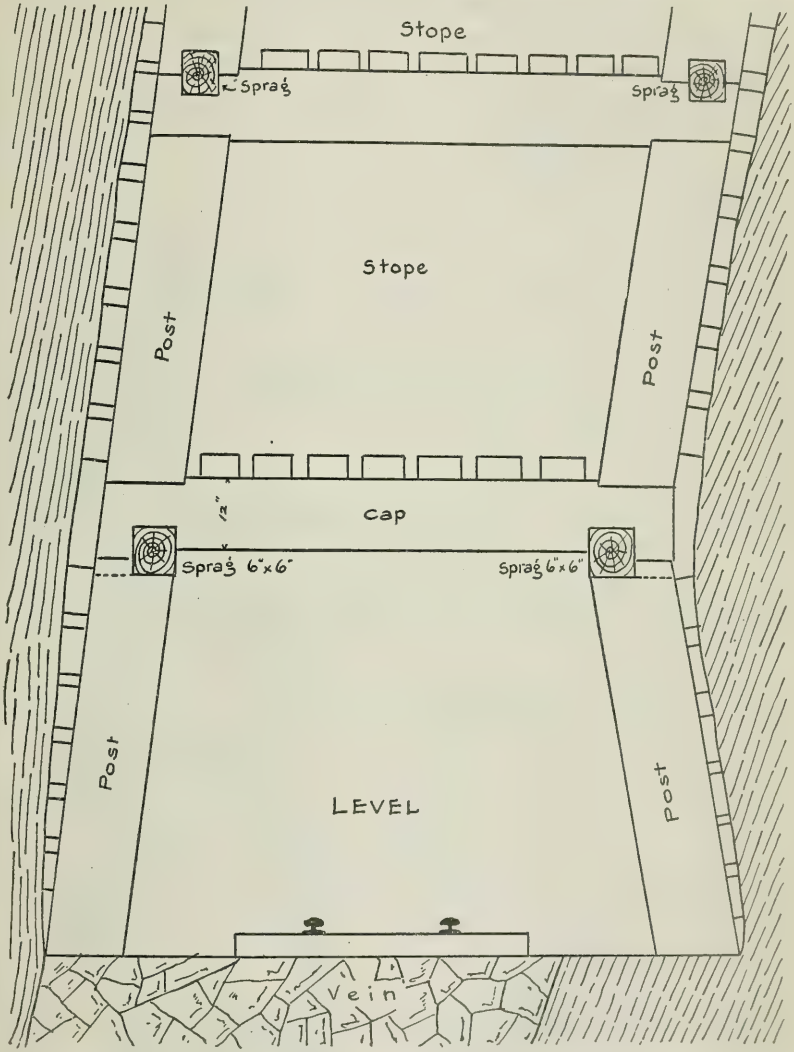
Jack Hanley Mine.—It is 2½ miles south of Greenwood. Prospecting is in progress. A rocking mill is in use. Four men are employed.——C. A. La Graves of Greenwood, superintendent.

CALAVERAS COUNTY.

In this county the mining industry is unusually prosperous, more so than in many years past. There are at work, and paying, no less than a dozen large mines, including three hydraulic mines, besides a great many small concerns, and a good deal of active prospecting is now in progress. Since the last report, a number of new enterprises have started up which are now idle, having proven unsatisfactory to the investors, but there are others which have, in a great measure, redeemed these more unfortunate ventures. Notable among the latter class is the Sheep Ranch Mine, which, after an idleness of nearly six years, has been reopened, and is again an active and, it is said, a profitable producer. The copper mines at Campo Seco are also being operated successfully, and in the Salt Spring Valley at Hodson the Royal Consolidated Mines are being worked on a much larger scale than heretofore. On the whole, Calaveras County may be said to be in a very prosperous condition. The development and exploitation of the new ore-bodies found in the Utica-Stickle and Gold Cliff properties at Angels will give a new lease of life to these important producers, and the operations of the Melones Consolidated Mining Company at Carson Hill will be among the most extensive in the State when carried to completion.

Gwin Mine.—It is 6 miles south of Jackson, Amador County. In its earlier history this mine was worked to a depth of 1540 feet through inclined shafts. Operations were suspended in the fall of 1882, and the property remained idle until 1894, when the present operators reopened the mine. A vertical shaft was started in the hanging-wall slates 485 feet from the vein. Work was commenced on May 1, 1894, and has progressed continuously since, with the exception of a period of about four months, when an attempt was made to unwater the old workings by means of a bore-hole to avoid flooding of the new workings from the old. It eventually became necessary to remove the water through the shaft of the old workings. This new shaft has continued to a depth of 1660 feet, having passed through the vein at about the 1200-foot level. There are tanks at the 300-foot level and at the 700-foot level. At the latter a cross-cut was run west from the station 374 feet, through slate to and beyond the vein, the foot-wall of which was reached 124 feet west of the shaft. At the 1000-foot level a cross-cut was run 69 feet west through the vein, which was here 15 feet 6 inches wide, the foot-wall being 58 feet west of the shaft. The foot-wall of the vein was

encountered in the shaft 1245 feet from the surface. Cross-cuts in the lower levels run to the westward have encountered two small veins and two dikes of light-gray intrusive rock. The first vein encountered is very persistent in strike and dip, though usually small. It has pro-



METHOD OF TIMBERING IN GWIN MINE

FIG. 28.

duced some rich ore. The ore-shoots of the main vein are of great length, varying in width from a few inches to 20 feet. Gouge is always present on the foot, and sometimes on the hanging-wall. The slates have a tendency to swell, and are the cause of considerable expense,

but cannot be compared in this respect to some of the Amador County mines. The vein is usually banded, and exhibits a branching tendency, there being many spurs running into the hanging-wall, but few into the foot. The lenses of quartz which are characteristic of this vein frequently build up a narrow into a large vein by splicing, and sometimes by overlapping. There is some black slaty material in the vein, but less than is found in many similar mines elsewhere. Large masses of the vein quartz are found crushed by pressure and movement, and in some places the quartz disintegrates rapidly from exposure by reason of the slaking of the carbonate of lime, which occurs in considerable quantities.

The mine is systematically opened, and substantially timbered with Oregon pine. The framing of timber is mostly done by machinery. Filling for the stopes is usually obtained from the hanging-wall, and broken by machines in chambers excavated for the purpose. Where feasible, inclined raises are put into the hanging-wall, and the chambers opened out from the raise, the rock broken passing by gravity down the incline into the stopes beneath. Where the character of the hanging-wall adjacent to the vein is such as to cause the ground to cave readily, level cross-cuts are run from the stopes into the hanging-wall, and chambers opened out at a safe distance from the vein, the filling being carried to the stopes in wheelbarrows. The Gwin Mine is one of the best managed properties it was my pleasure to visit, everything being done systematically with a view to producing the best economic results. The sketch (Fig. 28) represents the method of timbering stopes in the Gwin Mine. I was told, when at the mine, that the management had under consideration the advisability of running a lateral drift in the foot-wall, and opening the mine something on the lines suggested in the first part of this bulletin, under the head of "Methods of Mining."

Geologically, the Gwin Mine presents a striking contrast, when compared with the more important mines of Amador County. Here the vein occurs in the smooth, satin-like clay slates of the Mariposa beds, which are absolutely free from the pitted appearance so characteristic of the slates accompanying the ore-shoots of Amador County, which have been fully described under the head of Amador County, and also under the head of "General Geology of the Gold Belt." The formations encountered in sinking the Gwin shaft are diabase-tuff, clay slates, and small acid dike rocks. In the lower portion of the mine, a coarse, tufaceous rock, locally but erroneously called pudding-stone, has been encountered, which has been the cause of considerable difficulty in timbering, in carrying on mining operations. It is the intention of the company to make some changes in their shaft, and to sink to greater depth. What may be developed in this property at great depth is a matter of more than ordinary interest. Its present lowest level still lacks about 1000 feet of being as deep as the Kennedy, and it is a well-

known fact that the ore-bodies in the lowest workings of the latter show no deterioration in value.——Gwin Mine Development Company of San Francisco, owners. J. J. Crawford, secretary, Spreckels Building, San Francisco; F. F. Thomas, Gwin Mine, Calaveras County, superintendent.

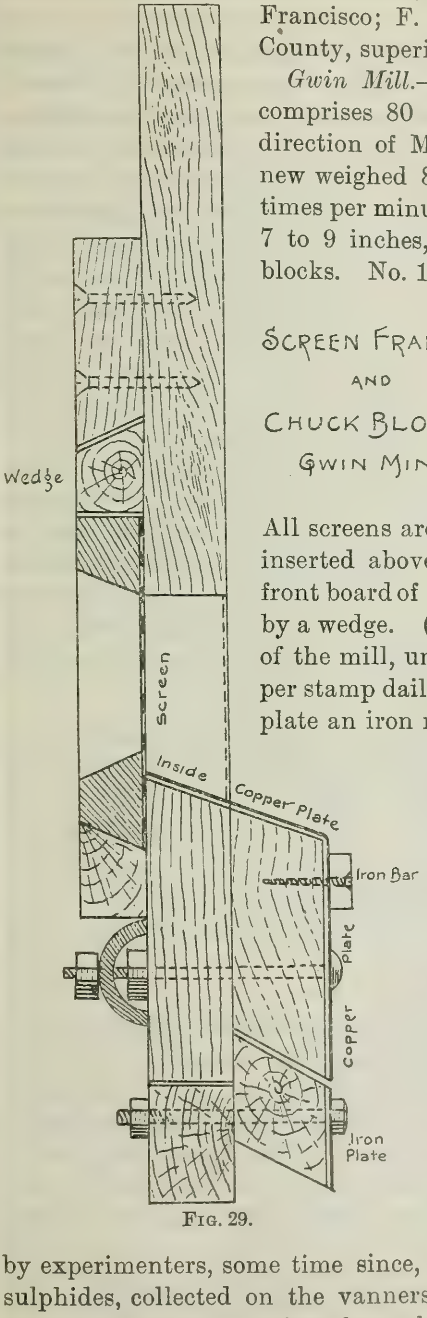


Fig. 29.

Gwin Mill.—The mill at the Gwin Mine now comprises 80 stamps, and is operated under the direction of Mr. J. E. Taylor. The stamps when new weighed 850 pounds, and drop 6½ inches 92 times per minute. The height of discharge is from 7 to 9 inches, and is regulated by three chuck-blocks. No. 16 brass wire screens are in use, and last one month. The screens are changed daily, scrubbed and dried, so that practically the screens are daily as good as new, until worn out. The size of the screen opening is 5 inches by 48 inches (discharge area). All screens are secured to small frames, which are inserted above the chuck-block and beneath the front board of the main screen frame, being secured by a wedge. (See sketch, Fig. 29.) The capacity of the mill, under the above conditions, is 4½ tons per stamp daily. To prevent scouring of the inside plate an iron rod is bolted to the plate. Its position is shown in the figure. The pulp from the battery falls onto the iron lip of the mortar, thence by a 3-inch fall onto a narrow board, and thence onto the apron plates, which are 48 x 60 inches, set at the grade of 2 inches to the foot. Thence it passes to the sluice plates, which are 24 x 120 inches, having at the end a trap for the purpose of catching mercury and amalgam. From the plates, the pulp passes to the vanner distributers, and from the vanners the tailings go to waste. In the cañon some distance from the mill a canvas plant was constructed by experimenters, some time since, but its use was discontinued. The sulphides, collected on the vanners, are heavy, probably coming from the quartz, and the values from the sulphides are largely confined to

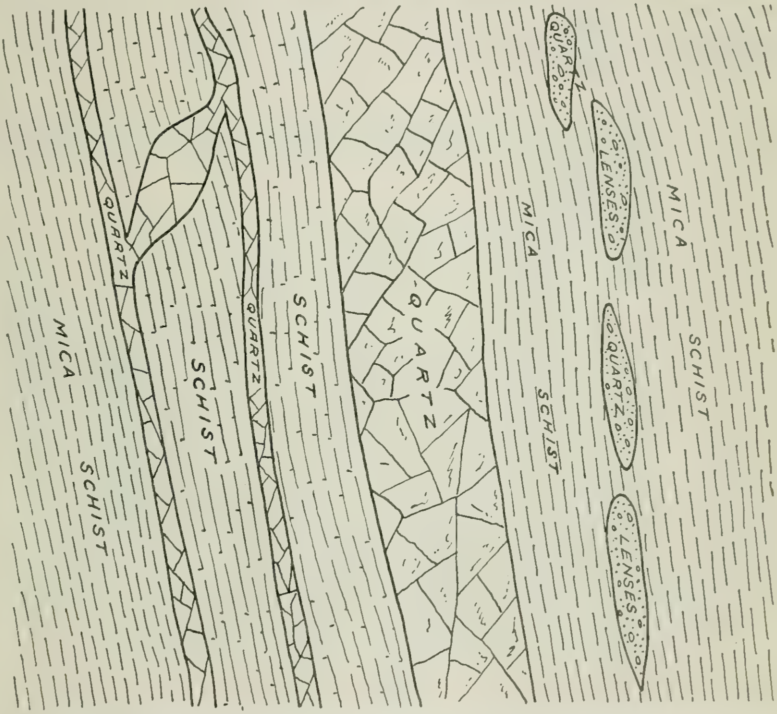
this class of material. A quantity of fine sulphides escapes with the tailings, which probably come from the slaty material. They are low-grade, and do not even justify the inexpensive further concentration on canvas tables.

The concentration plant consists, in the original mill, of sixteen 4-foot Frue vanners, one of which is of special design called the "Gwin." In the 40-stamp addition recently made to the mill there are sixteen 6-foot machines, all of this special design. These machines have an iron frame with cross-rods both longitudinally and transversely of the machine, which gives it great rigidity, and demands little attention when having been properly adjusted. The sulphides contained in the ore range from 1½ to 2 per cent. These are shipped to Selby's reduction works. Mr. Taylor states that the tailings escaping from this mill average about 25 cents per ton. The entire plant is run by water power, under a 400-foot head. A 6-foot Pelton wheel runs the 80 stamps, and a 24-inch wheel the concentrating machines. Power is distributed from the line shaft, which is beneath the feeder floor, by vertical belts to the cam-shaft pulley. The power is transmitted from the main wheel to the line shaft by a hemp rope 5 inches in circumference. Space has been provided in the building for an additional 20 stamps, for which there is abundant power. An electric plant has been installed for lighting the property. The mortars in the old mill differ somewhat from those in the new mill, those in the new mill being narrower. The mortars are lined throughout with deep plates and are thoroughly modern.

Sheep Ranch Mine.—This is at Sheep Ranch and on the east belt, 17 miles northeast of San Andreas. The mine was operated in former days by Haggin, Tevis, and Hearst, but was closed down in 1893, when a depth of 1200 feet had been reached, after producing about $3,000,000. It remained idle until 1898, when it was reopened by the present owners, who cleaned out the old shaft, retimbered it, installed a new and heavy plant of machinery, and thoroughly equipped the mine, in the belief that it was not exhausted. They went into the old workings on the 1200-foot level; extended them; drove the Pioche tunnel to a connection with the shaft at the 300-foot level, and started upraises at various points on the 1200-foot level, and began at once taking out rich ore. A new 20-stamp mill has been built; two air-compressors, and an electric plant and machine shop have been provided. The property comprises twenty-one claims, which include five known veins. The formation is a rather coarse mica schist, cut by dikes of diorite and coarse-grained granite. The Sheep Ranch vein, which is, so far as known, the hanging-wall vein of the series, is from a few inches to 3 feet in width, averaging about 18 inches. The ore is generally high-grade, often showing free gold, one shoot in particular now being operated south of the shaft above the 1200-

foot level, producing a dark blue, almost black, quartz, rich in free gold. The most of this rock is in demand by the manufacturers of jewelry, it thus paying far better than to crush it in the mill. The quartz usually occurs as a continuous waving vein, or as a succession of disconnected lenses, often contorted and twisted suddenly from its course, and when this occurs visible gold is usually abundant.

The accompanying sketch (Fig. 30) represents a characteristic sec-



VERTICAL CROSS SECTION of 1200 ft LEVEL of SHEEP RANCH MINE showing characteristic Vein Formation.

FIG. 30.

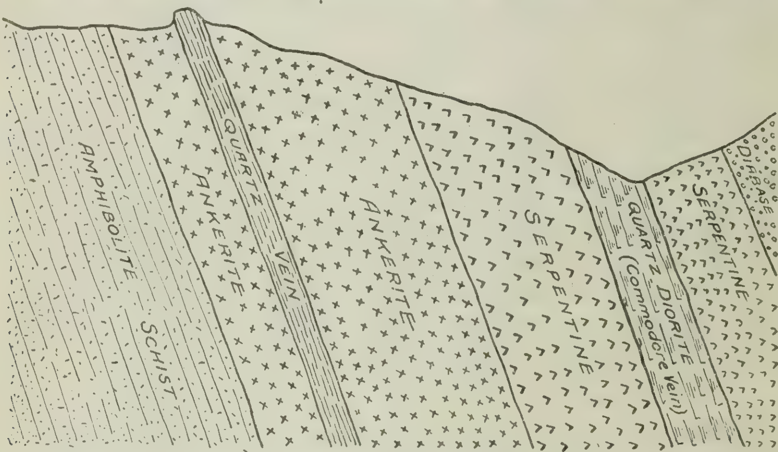
tion of the Sheep Ranch vein. Each of the several veins in this property has considerable superficial development.

A shaft is being sunk on the Lodi claim, one of the Sheep Ranch group, about 700 feet southwest of the main shaft. It is said that in former years very rich ore was taken from the Lodi vein. All machinery at the Sheep Ranch is operated by steam.——Sheep Ranch Mining Company, owners, 320 Sansome Street, San Francisco. D. Gutmann, manager.

Veritas (*Bode or Fellowcraft*) *Mine.*—At San Andreas. Since the last report, an inclined shaft (at an angle of about 55 degrees) has been

sunk 200 feet on a vein cutting through mica schist. At the 100-foot level a cross-cut has been run east to a zone of amphibolite schist and quartz, 4 to 8 feet wide. On the 200-foot level a cross-cut has been extended 135 feet east of the shaft to this vein, which is there 8 feet wide. The mine is equipped with a 10-stamp steam mill and water hoist, but is idle. On the hill, back of the shaft, is a zone of mineralized quartz schists, which prospects in gold, and is apparently the most promising part of the property, but nothing has been done with it in the way of development.——Veritas Gold Mining Company, owners. F. J. Solinsky of San Andreas, agent.

Commodore Mine.—One mile north of San Andreas, on the Mother Lode. A vertical shaft has been sunk 80 feet, thence continuing at an



CROSS SECTION showing succession of Formations at COMMODORE MINE, 1 mile N. of SAN ANDREAS, Calaveras Co. CAL.

FIG. 31.

angle of 75 degrees to the eastward to a depth of 300 feet. A level had been run north 250 feet April 1st, developing a wide zone of mineralized rock, which in its normal condition is quartz diorite (No. 21). This occurs as a wedge-shaped intrusion, coming from the north. Serpentine forms both the foot and hanging walls of this lode. To the westward, on the Masterson claim, is a broad zone of ankerite, so frequently mentioned as occurring elsewhere, with its massive quartz outcrop and characteristic mariposite, and to the eastward of the serpentine the formation is a normal diabase. A cross-section is illustrated in the sketch (Fig. 31).

The Commodore vein is somewhat of an anomaly in this region. It is a matter of interest to know that the quartz diorite, the alteration and mineralization of which form this ore-body, is almost identical, both mineralogically and in physical appearance, with a dike of quartz-

diorite (No. 20) intruding the amphibolite schist in the Union Copper Mine at Copperopolis, in this county. On the hanging-wall side of the Commodore vein is a zone of crushed material, 4 feet in width, in which occur rhombic crystals of dolomite. These, upon being fractured, may be observed to contain visible particles of gold. The mine is equipped with a steam hoist. There are 10 men employed.——Commodore Gold Mining Company of Stockton, owners. W. H. Clarey of San Andreas, superintendent.

Illinois Mine.—It is 6 miles south of San Andreas, on the Copperopolis road, near the Demarest Mine. Since the last report it has been equipped with a steam hoist and a 10-stamp mill. An inclined shaft has been sunk to a depth of 200 feet, and two levels opened. There are two veins, one running N. 5° E., and the other N. 30° W., converging northward. The formation is clay slate on the foot-wall, and amphibolite schist on the hanging-wall. A banded vein occurs at the contact of these formations, and a brecciated gray ore in the schistose portion. Idle.——B. K. Thorn of San Andreas, owner.

Demarest Mine.—This is 6 miles south of San Andreas, near the road to Copperopolis. It is an old mine, which has been reopened since the last report was issued. An inclined shaft has been sunk to a depth of 640 feet, and still sinking in April, 1900. It has a steam hoist and a 5-stamp mill. A short shoot of very good rock has been encountered in the several levels of this mine, the formation in which it occurs being diabase. A gouge usually accompanies the vein. This, in the northern end of the mine, lies on the hanging-wall side of the quartz, on the 300-foot level. Some distance south of the shaft there is a sudden flexure of the walls of the vein, the gouge passing over to the foot-wall side of the quartz. A second shoot of what is said to be good ore is known to exist under the bed of the creek south of the main workings, but this has not as yet been reached under ground. There are 18 men employed.——The Demarest Gold Mining Company of Angels, owners. T. H. Fullen of Altaville, superintendent.

The Ford Mine.—It is three fourths of a mile east of the Mother Lode, at San Andreas. The rock formation is chiefly chlorite schist, resulting from the alteration of diorite and possibly also diabase. The foot-wall (west) of the mineral belt of the Ford Mine is a hard, dense, quartz schist, often impregnated with iron sulphide (pyrite), which is usually auriferous, though at this place to a limited extent. The hanging-wall country is greenstone schist, not materially different from that exposed in the mine workings. There are two other rocks in the mine which lie near the foot-wall. These are, first, a hard, tough, dark-green rock (No. 23), composed of an aggregate of talc scales, often schistose, and in an extreme state of alteration passes over to talc schist and massive

steatite; second, a dolomitic rock (magnesian limestone), which is also much altered and passes over to talc schist.* This rock greatly resembles the ankerite of the Gold Belt, but shows no green mariposite. These two rocks are of structural importance only, as no ore has as yet been found in them. The Ford Mine may be described as a mineral belt consisting chiefly of chloritic and talcose schists, lying upon a quartz schist foot-wall, and having a hanging-wall of diorite, locally found altered into chlorite schist. The included belt is about 100 feet in width, and within it occurs large lens-like masses of quartz, and also vein-like sheets of quartz. The former are often found mixed with a gray rock which is a portion of the greenstone. These masses of quartz and fragmentary greenstone are a common feature of many important mines of the California Gold Belt, and often constitute large and valuable deposits of gold ore; but there are many millions of tons of rock seemingly identical, which are of little or no commercial value, owing to the extremely low tenor in gold. In the Ford Mine, as elsewhere, these large deposits contain a variable percentage of iron sulphide (pyrite). The large quartz bodies range from a foot or two to nearly 100 feet in width. There is a small vein near the foot-wall side which appears to possess elements of value, but to what extent it is impossible to say. This vein has a strike west of north, dipping easterly with the main quartz bodies, but not connected with them down to the 400-foot level. This vein and the small feeders of quartz running into it have produced rock of phenomenal richness. It also contains considerable quantities of petzite (gold-lead-silver-bearing tellurium). The gold and tellurium occur, in this small vein and the stringers leading into it, in what is known as an ore-shoot—that is, the distribution of the gold in the vein appears to be chiefly confined to a limited area, apparently 30 or 40 feet in length, and having a trend along the vein downward to the north at about 35 degrees from the horizontal. Gold has been found nowhere else in this vein than along the shoot as described. A persistent characteristic of this vein is the occurrence of thin films of iron sulphide incrusting the cracks and seams of the quartz. In this vein gold was found on the surface; south of the shaft on and above the 100-foot level; in the shaft at about the 100-foot level; in a winze sunk on this level north of the shaft; and in a drift north of the shaft on the 300-foot level, where, I am informed, a $900 pocket was found. The repeated occurrence of the gold and tellurium at the points indicated, shows clearly the downward and northward trend of the ore-shoot. The mine is equipped with a steam hoist and 10-stamp mill. The mine is developed to a depth of 700 feet, and I am informed that the shaft is to

* An investigation of similar rocks, near Forest Hill, Placer County, has led me to believe that the two rocks here described represent different stages in the alteration of the same rock.

be sunk 200 feet more. There are 10 men employed.——Ford Mining Company of San Andreas, owners. D. Gutmann of San Andreas, manager.

Angels Mine.—Is in the town of Angels, and is the second mine north of the Utica, and presumably on the same vein. It comprises a group of five fractional claims. The mine was worked extensively in former years, but until a year or more since has remained idle for many years. A vertical shaft has been sunk 350 feet, and three levels opened on a zone of amphibolite schist and quartz containing gold and auriferous iron sulphide. Only the north end of the property is in operation. The ore is crushed in a custom mill. The mine is equipped with a steam hoist. There are 40 men employed; 24 in the mine.——Angels Quartz Mining Company of San Francisco, owners. O. S. Buckbee of Angels, superintendent.

Lightner Mine.—In the town of Angels, the first extension north of the Utica, and on the same vein. The Lightner is a fractional claim, on which a shaft has been sunk to a depth of 447 feet, and five levels opened. The vein consists of a zone of amphibolite schist and quartz, ranging from 10 to 90 feet in width, and is essentially the same as the Utica Mine, geologically. The gray, granular dike rock, characteristic of the Utica-Stickle Mine, which forms large masses of the best ore of that property, is also prominent in the Lightner. The mine is substantially timbered with a modification of the square-set system. The property has a good hoisting plant, air-compressors, electric machinery, and a 40-stamp mill. The mill is operated by electricity, the hoist by steam. There are 50 men employed.——The Lightner Gold Mining Company of Stockton, owners. V. W. Miller of Angels, superintendent.

The Lightner Mill.—This is a modern mill of 40 stamps, run under the direction of J. E. Reaves. It originally contained 20 stamps, but was enlarged to 40. Twenty of the stamps weigh, when new, 955 pounds, and twenty weigh 750 pounds. The height of drop of the heavier stamps is 7 inches; that of the lighter, 7½ inches. The number of drops is about 100 per minute; the height of discharge, 8½ to 9 inches. A No. 1 punched tin screen is used. The capacity under these conditions is about 5 tons per stamp daily (by car measurement). This tonnage is probably due to the peculiar character of the ore, which consists of a considerable quantity of chloritic schist and calcite, and sharp grains of quartz, which pulverize readily, the stamp cutting the softer material rapidly. The gold is mostly caught inside the battery. The apron plates are 24 by 48 inches; the sluice plates are divided and are 20 inches by 20 feet. No traps of any kind are in use. There are 20 Frue vanners—twelve 4-foot and eight 6-foot machines. The ore contains about 2 per cent of pyrite. The pulp from the batteries is divided,

but not sized, before going to the vanners. The speed of the concentrating machines is controlled by means of a cone pulley. An experiment was made on a lower discharge (at 7½ inches), which resulted in scouring of the inside plates. This was discontinued for the higher

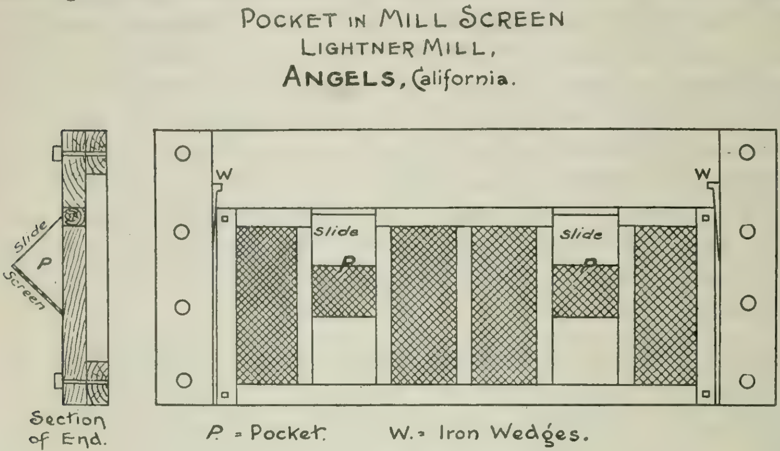


Fig. 32.

discharges now in use. Chrome shoes and white iron dies are in use in this mill. The latter last five months, crushing 750 tons of ore. The concentrates at this mill are worked by chlorination at the Utica plant. An ingenious screen has been invented by Mr. Reaves, which is illustrated in the accompanying sketch (Fig. 32). The screen is fitted with two pockets at the front, and these may be opened at will, and chips or other foreign matter removed by inserting the hand. The method of securing the screen to the frame is shown in the illustration. (Fig. 33 is an illustration of the Lightner chuck-block, with iron rods to protect the plate from scouring.)

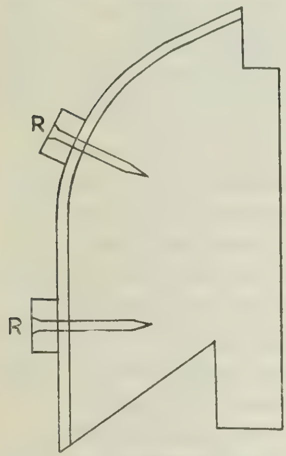


Fig. 33.

Utica-Stickle Mine.—It is at Angels. Since the last report, a vertical shaft has been sunk to a depth of 1370 feet. This shaft is located south and east of the old shafts, and is in the hanging-wall schists. It is substantially timbered throughout with heavy sets, and a large, expensive hoisting plant has been installed. This machinery sets on concrete foundations, which were constructed in the most substantial manner. For more than a year the lower levels have been flooded in the southern

part of the property. When the new vertical shaft was completed it was found that the hoisting plant, with the use of which the shaft had been sunk, was incapable of doing more than handle the water coming in at that point, and it was determined to discontinue mining operations in the lowest levels until such time as it became possible to put in a heavy plant that would economically handle both the water and ore.

The order for the new machinery was promptly placed, and it should have been in position in August, 1899, but owing to the inability of the makers, the Union Iron Works of San Francisco, to furnish necessary material, due to scarcity of iron, the great hoist was not ready for operation until early in September, 1900. During the past year or more all mining operations in this property have been confined to the upper levels of the mine.

The lower levels will now be unwatered and the large new ore-bodies discovered prior to the flooding of this portion of the mine will be worked vigorously. This property also includes the Madison and Gold Cliff mines, situated half a mile west of the Utica-Stickle group.

An extensive electric installation has been added to the Utica Company's plant. The generators are located above Murphys, on the company's ditch-line. The power is distributed to their various properties at Angels, where they also sell power and light the town. The Utica-Stickle and Gold Cliff mills are operated by this power, and also the mill of the Lightner Company, adjoining the Utica.

Gold Cliff Mine.—This is one of the Utica group, and is being operated through an inclined shaft 600 feet deep, sunk from the level of the old open cut. Four levels have been opened in this mine. The vein is found in a broad zone of amphibolite schist, with serpentine on the hanging-wall. The ore occurs in several zones, which overlap in the foot-wall going north. On the 400-foot level north of the shaft, the vein splits, being separated by a horse of diabase. Whether or not these diverging veins will re-unite is not known. The ore from the Gold Cliff Mine is crushed in the 40-stamp Madison mill. At the Utica Mine there is a 60-stamp mill, and the Stickle also has a 60-stamp mill, making a total of 160 stamps on the consolidated properties. There are 420 men employed in and about these works, distributed as follows: Utica, 125; Stickle, 90; Gold Cliff, 40; the mills, 25; chlorination and cyanide plant, 30; outside, 110.——Hayward, Lane, and Hobart Estate of San Francisco, owners. J. L. Shinn, manager. The Madison Mine has been idle for some time.

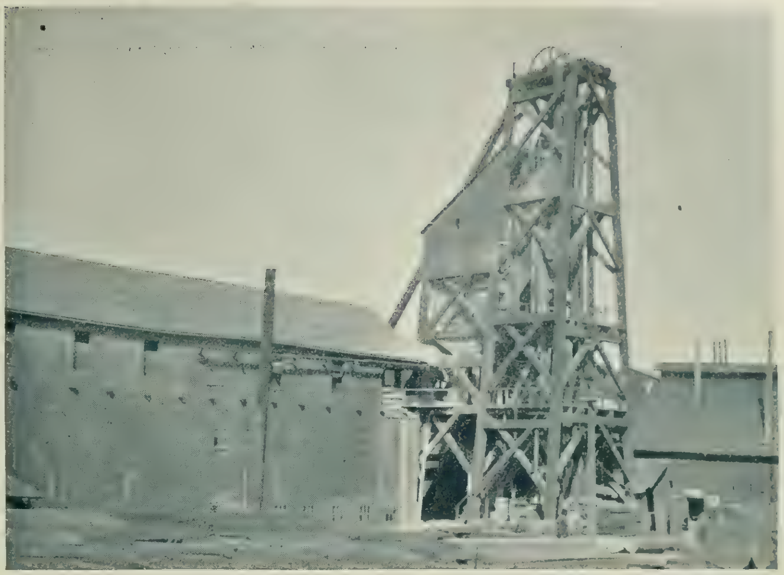
Utica Mills.—The three Utica mills are under the superintendence of W. J. Loring. The stamps of the Utica mills weigh 780 pounds; those of the Stickle, 835 pounds; and of the Madison, 920 pounds. These drop from 7 to 8 inches 105 to 107 times a minute. The height of dis-

charge in the Utica mill is 10 inches; Stickle mill, 7 inches; Madison, 5 inches. The Utica and Stickle mills are provided with No. 1 punched tin screens, and the Madison with No. 2. The capacity of these several mills will average about 5 tons per stamp daily. With the heavier stamps and low discharge of the Madison mill, it would be expected that the capacity of that mill would exceed that of the Utica or Stickle, but the Gold Cliff rock is much harder than that of the other mines.

Mr. Loring gives the following description of the Utica 60-stamp mill, and the daily routine work, together with method of making monthly clean-up, etc.:

The rock, as hoisted from the mines, is dumped at the head of the shaft over a grizzly made of 3-inch round iron bars, 10 feet long, placed 1¾ inches apart, and set at an inclination of 40 degrees. The bars are supported at each end by an iron casting, with recesses to receive them. Old stamp stems are used in the grizzly. At the lower end of the grizzly the rock passes to a Blake crusher 10 x 16 inches, being fed by gravity. One crusher of this size handles all the rock for the 60-stamp mill. One man is employed here on each ten-hour shift.

The crusher and grizzly set over a 50-ton bin, from which ore is conveyed to three bins of 200 tons capacity each in the mill by means of a dump car. The bins discharge into Challenge feeders. In the Utica mill they have made a practice of keeping on hand a new cam shaft with ten cams in place, which, in event of breaking the shaft, may at once take the place of the broken shaft. In case of such difficulty, much time is saved by this arrangement. The discharge in the batteries is 10 inches high; three differential chuck-blocks are in use, keeping the discharge as nearly uniform as possible. Manganese steel shoes are used; these are 10 inches long, 8½ inches in diameter of face, and weigh, new, 177 pounds; when worn out, they weigh but 28 pounds; their life is about 296 days. The dies are made of hard iron, and last 120 days; they are 5 inches high, 8¾ inches in diameter of face, and 9½ x 9½ inches base area; they weigh 84 pounds, and after using, about one half of this. Round needle punched tin screens are used in sheets 10 x 14 inches; No. 1, or 30-mesh, has been found to give the best satisfaction, and lasts from 15 to 20 days. Before using, these are burned over a moderate fire of charcoal, for the purpose of removing the tin, to prevent amalgamation of the tin. This anneals the metal, and makes it a very tough, durable screen. A splashboard made of 1 x 12 inch clear pine, having the full width of the screen, is suspended to the screen frame by two eyestraps riveted to each end of the board and two hooks screwed to the screen frame. A strip of canvas 6 inches wide is tacked to the lower end of the board, to confine the splash to the apron. Underneath the screen is bolted an iron apron, which constitutes a portion of the mortar, and being an inch below the lip of the mortar,



North Shaft and Mill, Utica Mine, Calaveras County.

The Keystone Mine and Mill, Amador City.

permits the insertion of a rough board 1 x 12 inches, which lies flush with the upper edge of the lip of the mortar. Upon this the pulp from the screen falls, and it is considered a good amalgamator. After being in use a short time, it amalgamates quickly, but does not stand the jar as well as the copper plate. A splashboard of this kind can be cleaned in one eighth of the time required to clean a copper plate. The board is protected by a 2 x 6 inch board, extending across the apron, and having a $\frac{5}{8}$-inch hole bored at each end to receive two hooks fastened to the battery posts. Four inches below the board, on the apron, runs a trough in which are two apertures 3 inches square, through which the pulp passes to a copper plate 5 inches wide, with a pitch toward the mortar, whence it passes to the sluice plates, 2 feet wide and 22 feet long, covered with $\frac{1}{16}$-inch copper plates set on a grade of 2 inches to the foot. Each battery has two separate runs of these plates, set independently, provided with wedges to adjust the grade. Before putting on the plates, the tables are dressed down in the center about $\frac{1}{16}$ inch for the full length. This causes the pulp to run in angular waves across the plate. If the tables are left plain without the center depression, it is a difficult matter to cause the pulp to be evenly distributed over the plate, as it usually flows to one side or the other. The first 8 feet of plate at the upper end of each sluice is raw copper, the remaining 14 feet being plated with $2\frac{1}{2}$ ounces of silver to the square foot. The plating is done in the works of the company. The plates are cleaned every morning.

A plug of soft wood is driven into one of the 3-inch holes of the cast-iron aprons previously described, causing the pulp to run through the trough and out of the other 3-inch hole discharging on the other plate. The plate to be dressed is first washed with clean water to remove sand, then sprinkled with quicksilver, and rubbed vigorously with a whisk-broom for the purpose of loosening the amalgam. About once a week a weak solution of cyanide of potassium is used in dressing the plate. This operation must be done with care, as the application of too much cyanide causes the plates to become glazed and brittle, when they are no longer fit for the use for which they are intended. After the plates have been thoroughly rubbed with a whisk-broom, they are rubbed downward with a piece of pure India rubber $\frac{1}{2}$ inch thick, 4 by 7 inches in area. The amalgam is then taken up, together with the sulphides which may have adhered to the plates during the twenty-four hours. The plate is then lightly sprinkled with quicksilver at the head, and lightly brushed with a whisk-broom its full length. The last plate is always brushed upward from the lower end, to place any amalgam which should be hanging to the lower edge of the plate in a position where it may be seen and collected. By this method, two men can dress twenty-four

sluices, 22 feet in length by 2 feet wide, in from one and a half to two hours.

For the purpose of saving the rich sulphurets which have adhered to the plates, and which are often worth $10 per pound, the amalgam collected each morning is cleaned in a tank used for that purpose only. At the end of the month this tank is cleaned out and the sulphurets are charged with 25 pounds of quicksilver, into an amalgamating barrel of 40 inches diameter and 48 inches long. This revolves for eight hours, at 14 revolutions per minute. The charge is taken out through the head with a dipper, is panned and settled. The amalgam is cleaned in the usual way, and the sulphurets sent to the chlorination works in a wooden bucket. At the lower end of the sluices is a tail-box, having the width of a double sluice, with a drop of 3½ inches, and a width of 5 inches on the bottom. This box has a wing its full length, with a pitch of about 45 degrees toward the sluice plates, and extends to within ½ inch of the bottom of the box. The wing causes the pulp to pass under it and keep the box clear at the bottom, catching any free quicksilver. From this opening extends a sluice 12 inches wide and 8 feet long, the upper end of which is provided with ½ x ½ inch riffles 2 inches apart, while below the riffles are 6 feet of silver-plated copper plates. This box has a grade of ⅞ inch to the foot, and from it the tailings pass to the concentrators.

Each battery has three concentrators. There are in use in the several mills of the company fifty-four 4-foot Frue, six 4-foot Union, and sixteen 3 foot 10 inches Tulloch machines. A series of comparative tests was made some time since, which showed little difference in the value of the tailings passing the machines. Mr. Loring made special experiment with several of the Frue machines. The machine has a shaking-frame 12 feet long and 4 feet wide. The back roller was dropped 3 inches by putting a block of wood between the side rail and the bearing that supports the roller. Then a number of small rollers which carry the belt were taken out, reducing the total length of the concentrator to 8 feet from the center of the head roller to the center of the small roller. The belt from the small roller to the back roller had so much grade that nothing was saved on it, so that by this arrangement of the concentrators the effect was the same as though the machines were but 8 feet long. Tailings assays showed as follows:

From the altered machine, 4 x 8 feet	$0 33 per ton.
From the unaltered machine, 4 x 12 feet	41 per ton.

This shows a saving of 8 cents per ton in favor of the short concentrator. This being the case, it would appear that a 12-foot machine is unnecessarily long. On each concentrator is a discharge, which deposits the sulphurets in a box directly under the head roller of the machine, and from this box the concentrated sulphurets are removed daily. A

car holding 900 pounds is used to convey them to the dump-house. Two samples are taken from each car with a 15-inch sampling iron, and after all concentrates for the day have been taken out and sampled, the aggregate sample is sent to the assay office, together with the aggregate of the samples of tailings, taken every three hours. These samples are assayed every day, and a record kept. The tailings from the concentrator run through a flume three fourths of a mile long, and are passed over a slimes plant of the Gates type. The concentrates from the slimes plant are conveyed by wagon to the chlorination works, where they are worked in a cyanide plant attached to that department of the works.

After a run of fifteen or twenty days, depending on the character of the ore, a general clean-up of the mills is made, as follows: The feed is shut off from three batteries until they have been "pounded out"; the stamps are then hung up, the water shut off, and two rectangular pans, 15x14 inches in area, 3 inches deep on one side and 2 inches on the other, are placed in front of each battery, the low side of each being slipped under one of the holes in the apron. These pans are made in this form to keep the upper edge as nearly level as possible when sitting on an inclined plane. The amalgam adhering to the screen frame is taken off with a scraper, and deposited in a gold-pan. The screen frame is then removed and washed; afterwards the chuck-block is taken out and placed in the clean-up room, to be cleaned; the wooden apron is then scraped and the amalgam put into a bucket; the coarse battery sands are then shoveled into a box provided for that purpose, and the pans with the cleanings from the screen frame are successively put under each stamp, which is thoroughly cleaned of any amalgam found in key-ways or between the boss-head and shoe. After each stamp has been thoroughly cleaned in this way, the amalgam is taken to the clean-up room, a check being kept on the weight of that from each battery separately. The dies are then removed and washed on the apron, and the batteries cleaned out, all the hard sand that has accumulated around the dies being put in an amalgamating barrel. After the mortar has been thoroughly cleaned, about half an inch of sand is spread on the bottom of the mortar, the dies are returned to their respective places, coarse sand packed in, and the chuck-block, which has been cleaned, replaced; the screen is replaced and keyed; the apron washed, and everything cleaned, down to the rectangular pans previously mentioned. These pans, and the buckets used around the battery, are washed into the amalgamating barrel. By the time the clean-up man has completed washing the buckets and pans, the man employed in looking after the self-feeders has started the cleaned-up battery, and has its neighbor ready to be opened. Three men on the batteries and three men in the clean-up room can clean up twelve batteries in three hours. When the

battery is first hung up, the small spreader plates are taken to the clean-up room, and the amalgam obtained is dropped into a tank, which, after the clean-up, is cleaned out and charged with other material in the amalgamating barrel.

After the mill has been cleaned up, 150 pounds of quicksilver is put into the barrel, with sufficient water to give a depth of 12 inches over the charge. The barrel is then closed, locked and sealed, and the belt put on, which drives the barrel at 14 revolutions per minute. This charge is run 30 to 48 hours. Underneath the barrel is a tank of equal capacity, from whence a sluice 22 feet long and 12 inches wide with a grade of 1½ inches to the foot, provided with silvered copper plates, conveys the pulp and water to either of two settling tanks as desired. When the barrel has run its full time, it is stopped with the head up, the head removed, and a stream of clear water under high pressure turned in, causing the slimes to come to the top of the barrel, overflow, and fall into the tank beneath, from which they pass through the sluice into a tank of 2000 gallons capacity. When the slimes have been washed out, the water is shut off. A bucket is set under the 1¾-inch plug-hole in the barrel, and the charge is drawn. The quicksilver first flows out, falling to the bottom of the bucket. A stream of water is kept running through the barrel to wash the sand through the discharge hole, and the bucket is thoroughly scraped, so that the sand will overflow, leaving the amalgam in the bottom, the "iron" next, and the sand on top. The iron is taken out as it accumulates, and after it has all been collected, it is screened through a ⅛-inch screen and the screenings panned in the clean-up tank. The result is put back into the amalgamating barrel at the next regular clean-up. The amalgam from the barrel is thoroughly cleaned and squeezed through white drilling. The amalgam balls weigh from 8 to 12 pounds, and retort about 38 per cent gold. The day before the buckets are to be cleaned, the accumulations on the sluice plates are scraped off with steel scrapers made of old files turned at one end about 2 inches, and ground to a sharp edge. The first 8 feet of raw plate is scraped in this way, leaving the 14 feet of silvered plate to run six months more without scraping. Great care must be taken in scraping silvered plates, as the silver cuts easily, spoiling the plate and making low-grade bullion. The amalgam thus collected is put in a small amalgamating barrel 15 inches in diameter and 24 inches long, which is run 28 revolutions a minute, quicksilver being added, with enough water to make a thin paste of the charge. The charge is run for twenty-four hours, when it is drawn off in a bucket and cleaned in the usual way, the sulphurets being saved in the cleaning tank previously described. This amalgam yields from 28 to 30 per cent gold.

Quicksilver is fed to the battery every hour; the amount being

regulated by the value of the ore, and this must be judged by the amalgamator from examination of the board directly under the splash of the battery, where the pulp first falls from the screen. Every ounce of quicksilver that is fed into the battery is weighed and recorded at the end of each shift, and at the end of the run the amount of quicksilver thus fed furnishes a basis for calculating the probable result of the clean-up before it is made. The retorts are lined with oak wood ashes, free from dirt; the ashes are sifted through a 30-mesh screen, and made into a paste with water; with this paste, the trays and retorts are lined, and the head thickly sealed. The ashes do not shrink like clay, to which it is superior in many ways.

The mortars in the Utica mill are of an old-fashioned type, not having been provided with liners. After being in use several years, it was found necessary to do something if the life of the mortars was to be prolonged, as the ends were badly worn just above the dies The stamps were set 10 inches between centers, using 8½-inch shoes, leaving a space of 1½ inches between each two shoes. The 9-inch dies up to that time had a life of 59 days, and the chrome steel shoes were being used 191 days. In order to line these mortars, Mr. Loring reset the stamps, using a guide with 9¼ inches between centers, and leaving ¾ inch between stamps. In this manner 1½ inches were gained at each end of the mortars, allowing room for an end liner, which served to key the front and back liners. The back was filled with wood, carefully fitted in place with the liner, saving considerable weight of unnecessary iron. The back liner is 13 inches high, and stands at an angle of 77½ degrees, the foot being 1½ inches from the base of the die. These dies are made with 8¾-inch face, while the shoes have but 8½-inch face. It is claimed by Mr. Loring to give better results than when both shoe and die are of the same diameter.

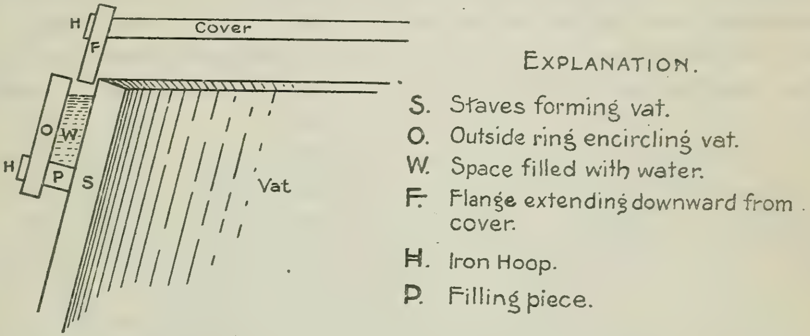
The chuck-blocks are made of wood covered with copper, ⅛ inch thick and 8 inches wide, the full length of the battery. In the center the copper is bent to fit the wooden block, the upper half being set at an angle of 45 degrees, the lower half standing vertically. At the lower edge of the block, and projecting ¼ inch over the copper, is bolted a ½ x 1 inch iron strap the full length of the copper. At the bend in the copper, or about 2 inches above the bottom iron, is bolted a second iron strap, ½ x ⅝ inch, the full length. The bolts holding these iron straps are countersunk, and the iron bars act as a protection for the amalgam which accumulates between them, and it has also been found to prevent the scouring of the upper section of the plate. There are used 8½ gallons of water per battery of 5 stamps per minute, and in addition 2¼ gallons per minute outside for each battery.

All chips, shoe wedges, and other wood used about the mill, are saved and burned in a 5 x 8-foot furnace constructed for that purpose.

The furnace has a cement floor; above it are placed grate bars to the full size of the furnace. The furnace measures from cement floor to top of bars, 15 inches; from the top of bars to the top of the arch, 5 feet; at the top of the furnace is a charging hopper made of cast-iron, with a door to fit it. When the charge has been burned, the ashes are removed and screened to remove nails, etc., that may be in the charge. The ashes are put in the amalgamating barrel with 10 pounds of quicksilver, and ground for six hours sharp, as a longer time would probably cause the charge to "flour." From 6 ounces to 2 pounds of amalgam is obtained by this method every month. All the cleanings from the mill are put into this barrel and ground for such time as the case may require. In this way many thousands of dollars are saved around a large plant, by care. The amalgam from the chuck-blocks is ground in an iron mortar 12 inches in diameter, the muller of which has a connection made in such a way that it can be stopped or lifted as desired. It will grind a charge of 14 pounds, and has a speed of 65 revolutions per minute. The labor employed in the mill is as follows: One man to each shift of twelve hours, whose duty it is to look after the feeding of the batteries; one night amalgamator, who attends to the amalgamating and looks after the mill generally; one concentrator man on each twelve-hour shift, who attends to 36 concentrators; one day amalgamator and helper, who attend to the amalgamating and general repairs about the mill; one superintendent, who has charge of everything connected with the mills and plating works; thus seven men, besides the superintendent, operate a 60-stamp mill. Owing to the fact that the company own their power, against which they make no charge for the plant or deterioration, the cost of milling at the Utica mills is very low, being, before the recent rise in the price of iron, about 14 cents per ton.——W. J. Loring, superintendent, Utica Mills.

The Utica Chlorination Works.—This plant consists of seven furnaces, having a daily capacity of 29 tons. F. C. Beedle is superintendent. Four of the furnaces are in constant operation. They are 72 x 13 feet, and have a capacity of 4¾ tons each daily. The material treated in these furnaces is iron sulphide, concentrated from the Utica-Stickle and Gold Cliff ores. The tanks are made of redwood held by ⅝-inch round iron rods, each in three sections and secured with screw clamps. This method of clamping tanks draws the staves evenly, secures great firmness, and renders the tanks perfectly water-tight. The covers of the tanks are no longer "luted" on as formerly, but are provided with a downwardly projecting flange, which drops in an annular trough encircling the tank and filled with water. The accompanying diagram (Fig. 34) illustrates this construction of the air-tight water joint. The covers are raised by means of a chain block suspended from an overhead traveler. The tanks have a capacity of 5 tons each. The pipes

from the chlorine gas generators, which latter are very large, are so arranged that when the gas is turned into No. 1 tank, having permeated the ore below, it passes from the top of No. 1 tank into the bottom of No. 2, so that there is no waste of gas. In generating gas, 100 pounds of salt and 90 pounds of black oxide of manganese are used. To this, sulphuric acid is automatically added, until it ceases to evolve gas. Liquid chlorine was at one time tried in these works, but Mr. Beedle said it was found to cost twice as much as making gas by the above described method, though otherwise satisfactory. The ore is introduced to the reverberatory furnaces containing 5 to 10 per cent moisture, in a charge of 2600 pounds. It is spread in a 2-inch layer on the first



SECTION of Cover and Top of Vat, Chlorination Works, UTICA MINE, ANGELS, Cal.

showing air tight water joint.—

FIG. 34.

hearth. After two hours it is stirred, and later it is restirred three times before being raked forward to the second hearth. On the second hearth, 40 pounds of salt are added to the charge; on the third hearth, the ore, having been thoroughly roasted, is withdrawn from the furnace, cooled and charged into leaching-vats. One and one-quarter cords of wood are required to roast 5 tons of ore.

Utica Cyanide Plant.—In this plant 8800 pounds of slimes obtained from the canvas plant are treated in eight hours. This is charged in steel tanks, and agitated 6 hours with a 5 per cent solution of potassium cyanide. The pulp is discharged into a vacuum filter, and is first washed with sump solution, and later with fresh water. The results are said to be entirely satisfactory. The auro-cyanides are precipitated on zinc shavings.

Bovee Mine.—This property adjoins the Fox or Angels Mine on the north, at Angels. It has been idle for many years.——The Marshall Mining Company, owners. E. P. Lynch of Angels, agent.

Perlina Mine.—At Altaville, northeast of the Angels Mine. It has an inclined shaft 75 feet deep, from which drifts have been run on the vein. The property has been superficially worked for years, the ore being crushed in a 4-stamp mill. The vein has never been cross-cut, and its width is unknown. As far as known at this writing, the vein has a width of from 4 to 12 feet, between two gouge seams. The formation is diabase and amphibolite schist. There are 3 men employed.——J. G. Maltman of Angels, owner.

Great Western Mine.—At Altaville. It has a vertical shaft 220 feet deep, with drifts at 50, 100, and 200 feet south of the shaft, no work of consequence having been done to the northward. There is a stope at the 50-foot level and one at the 100-foot level. On the latter level, it is said the vein is from 8 to 20 feet in width. The hoisting machinery has been removed and the mine is idle.——Seifert & Baumhogger of Angels, owners.

St. Lawrence Mine (Bruner or Bald Hill).—This mine has been reopened since the last report, and an inclined shaft sunk 400 feet at an angle of 64 degrees; there is a level at 100 feet and another at 400 feet. An open cut on the surface exposes a shoot of ore 80 feet in length, which was worked down to a depth of 60 feet many years ago. The trend of this shoot is to the south, at an angle of 40 degrees; two other shoots are known to the northward. The formation is diabase and chlorite schist. The vein consists of a mixture of quartz and diabase, impregnated with auriferous iron sulphides and free gold. The mine is equipped with a steam hoist, but has no mill. The south drift at the 400-foot level had not reached the ore-shoot at the time of my visit, but drifting was in progress.——St. Lawrence Gold Mining Company of Hanford, Cal., owners. A. J. Cameron of Angels, superintendent.

Bolytho Mine.—This is 1 mile south of Angels, and has been mentioned in previous reports. It was originally worked as a pocket mine, and as such produced several thousand dollars in gold. Expensive development was then undertaken, with a view to working it as a milling proposition, but up to this time the experience of the operators has been rather unsatisfactory. The last work performed was the sinking of a vertical shaft to a depth of 300 feet; this shaft passed through a succession of formations—diabase tuff and tufaceous slate, characteristic of the Gold Belt, being most prominent. These formations are intruded by a dike of straw-colored rock, which is identical with the intrusive rock found in the Utica-Stickle, Gold Cliff, and other important mines in this section. The dike is from 30 to 40 feet wide, and carries much finely disseminated iron sulphide, which is doubtless auriferous, but to what extent is not known by the management, as no attention was paid to it, for the reason that it was not massive quartz. It is the

intention of the company to cross-cut from the bottom of the shaft to the eastward and again intersect the dike, which is, undoubtedly, whatever its value may be, the main ore zone of the mine. When this is done, long drifts will be run for the purpose of prospecting. Geologically, this mine possesses many of the features common to the best mines of this section. In addition to this shaft, an inclined shaft has been sunk 300 feet on a west vein, and thousands of feet of drifting and cross-cutting have been done in the upper portions of the mine in search of pockets and pay rock. The vertical shaft is equipped with a steam hoist.——Bolytho Mining Company, Appraiser's Building, San Francisco, owners. E. P. Lynch of Angels, superintendent.

Big Bonanza Mine (Harris or Oriole).—It is 1 mile south of Angels, and has been developed by a vertical shaft, which was 425 feet in depth May 1, 1900. A level has been run at 130 feet, 60 feet southeast, and another at 200 feet. The formation in which this mine occurs is augite diorite, in which occur fine-grained phenocrysts of hornblende and augite. This rock near the vein is altered to chlorite schist. The vein consists of a zone of quartz and schistose rock, dipping 75 to 80 degrees to the eastward. The mine is equipped with a substantial steam hoist, but has no mill. There are 15 men employed. Sinking is in progress. It has been recently reported that 30 feet of ore has been developed on the 400-foot level, 5 feet of which is high grade.——Oriole Mining Company of Stockton, owners. John H. Heard of Angels, superintendent.

Drake Properties (*Ltd.*).—These are a mile southeast of Angels. Two shafts have been sunk—one 900 feet, the other 300 feet—vertically for the purpose of prospecting. The formation is diabase and black tufaceous slate, the latter being cut by a small dike with quartz and pyrite. Idle.——Drake Properties (Ltd.) of London, owners. F. J. Solinsky of San Andreas, agent.

Tulloch Mine.—It is 2½ miles south of Angels. After a long idleness it has been reopened and sinking is in progress in the shaft, which September 1st was down 250 feet. Steam hoist. There are 12 men employed.——Mr. Blevin of Angels, superintendent.

Relief Mine.—It is 1 mile south of Angels. It has a cross-cut tunnel 165 feet long, and a winze sunk on a zone of schist 90 feet below the tunnel level. The mine has no machinery. Idle.——Bonded to San Francisco company. Mr. Hogarth of Angels, owner.

Melones Consolidated Mines.—This group of mines is on Carson Hill, reaching from the summit of that eminence to the Stanislaus River, and embraces seven claims extending along the lode for a distance of a mile. The claims are the Reserve, Last Chance, Melones, Enterprise, Mineral Mountain, Keystone, and Stanislaus. These mines were among the first worked in the county, and the several claims have been

developed to depths varying from superficial, though large cuts, to shafts 300 feet or thereabouts in depth. The development undertaken by the present owners consists in an extension of the South Carolina tunnel. (This property adjoins the Melones Consolidated on the east.) It was run through the Enterprise and Reserve ground under the large open cuts on the surface, and connection established. It is 621 feet below the collar of the Reserve shaft. This development has exposed large veins of ankerite and quartz with amphibolite schist, all of which is gold-bearing, with auriferous sulphides. To what extent these great veins are auriferous is of course a very important factor, viewed from the commercial standpoint. The values vary greatly, ranging from many thousands of dollars per ton to a mere trace of gold. Large samples taken systematically from cross-cuts on the veins show values varying from $1.50 to about $9, the greater portion running from $2.50 to $3.50 per ton, though some portions average better than this, according to statements made by the management. A new tunnel (designated as No. 3), 6 feet 6 inches by 9 feet clear, was started to run under the South Carolina tunnel about 200 feet lower. This tunnel is now in about 3500 feet, and judging from the character of the formation passed through in the last 100 feet is nearing the vein. The tunnel cuts diagonally across the formation, and is being driven through the foot-wall country. It is perfectly straight, has a double track throughout, and is a creditable piece of mine engineering. Machine drills are in use, the compressors being situated near the mouth of the tunnel. There are still several hundred feet to run before this tunnel reaches a point beneath a winze sunk from the South Carolina tunnel. A raise of 65 feet from the new tunnel will make this connection at a point 1000 feet below the cropping on the summit of Carson Hill. The grade for a 120-stamp mill has been completed, and a large amount of machinery is on the mill site. The first attempt to construct a dam across the Stanislaus for the purpose of furnishing power for this property was a failure, and a new site was chosen a few feet higher up the stream. This is about 2½ miles above Robinson's Ferry. The dam is being put in at this writing (September 1, 1900), and it is stated that no obstacles to its successful construction have been encountered thus far. The water diverted by the dam will be conducted by ditch and flume to a point opposite the mill site, and it is calculated to furnish power for the entire plant. This is one of the largest mining operations in the State, but much still remains to be done before it can be placed on an operating basis.——Melones Consolidated Mining Company of Boston, owners. W. C. Ralston of Robinson's Ferry, manager.

Last Chance Mine.—Near the town of Angels, on the southern limits. Nothing has been done here since the last report. It has an inclined shaft 73 feet in depth.——G. C. Tryon of Angels, owner.

San Justo (*Carson Creek*) *Mine*.—The work in progress May 1, 1900, is in a south drift on the 250-foot level, where a new ore-shoot has been discovered. The mill, which had long been idle, was started up May 1st, and the chlorination works one month later. The mill has 40 stamps; 40 men are employed.——The San Justo Mining Company, Parrott Building, San Francisco, owners. V. W. Miller of Angels, superintendent.

Greek Mine.—Near the road between El Dorado and Railroad Flat, 20 miles from San Andreas. It is developed by a shaft 170 feet deep, with a drift 120 feet long at the 100-foot level. The vein cuts vertically through mica schist, and has the remarkable accompaniment of two dikes—the older a dark-green, hard diorite; the later, a light-colored, finely grained dike of acid type. The latter is usually found in contact with the vein, which is either banded or massive, showing in places coarse gold. The general tenor of the ore, however, is low grade. It is equipped with a steam hoist and a 5-stamp mill. Idle.——Greek Mining Company of San Andreas, owners. F. J. Solinsky of San Andreas, agent.

Ritter Mine.—This is 1½ miles north of Mountain Ranch, or El Dorado. It is opened by a tunnel 410 feet in length, driven on a small vein of granular quartz having a peculiar schistose structure. The rock is extremely hard and flinty. One shoot of ore developed by this tunnel and a raise produced considerable high-grade specimen rock. The vein strikes N. 30° W., and is intersected by a larger quartz vein, striking north and south and dipping 65 degrees east. This vein is dislocated by the smaller vein a distance of 40 feet. A small force was at work in the spring of 1900.——Rodesino Estate of Mountain Ranch, owners. Bonded to S. Redmond of San Andreas.

Blue Jay and Yellow Hammer Mines.—These mines are 2½ miles east of Mokelumne Hill, near the Calaveras River, and comprise 3100 feet on a banded vein in Calaveras formation. The vein is from 2 to 6 feet wide, cutting mica schist and slate. It is usually accompanied by a small acid dike. The property is in the prospective stage.——F. Courtmarsh et al. of Mokelumne Hill, owners.

Esperanza Mine.—It is 2½ miles northeast of Mokelumne Hill. Developed by an inclined shaft 1000 feet deep. The property is equipped with hoisting works, 30-stamp mill, and chlorination plant of three furnaces; motive power, water. Idle in the spring of 1900, but it was said that the mine was about to resume operations.——Esperanza Mining Company, 220 Sansome Street, San Francisco, owners. Prescott Ely of Mokelumne Hill, superintendent.

Calaveras Mine.—It is 2½ miles north of Mokelumne Hill, near Big Bar bridge. It was described in former reports as the Garner. The vein,

which occurs in diorite, is opened through an adit tunnel. A vertical shaft is being sunk from the surface, calculated to reach the vein at a depth of 350 feet, and a winze is being sunk below the tunnel, 70 feet north of this shaft. The vein strikes N. of E., dipping W. 57°. The ore is crushed in a 10-stamp mill, situated on the opposite side of the Mokelumne River, in Amador County, power being furnished by a turbine wheel, using about 1200 inches of water. The mill runs during the day only. At the mill an air-compressor furnishes power for drills used in the mine on the other side of the river. There are 24 men employed. ——Calaveras Gold Mining Company, owners. Peter Houghton of Mokelumne Hill, superintendent.

North Star Drift Mine.—This is 2 miles south of Mokelumne Hill, on the Old Woman's Gulch blue lead. The channel has been reached by means of a cross-cut tunnel, in 1360 feet March, 1900. This tunnel is 6½ x 10½ feet. Nine men are employed, there being as yet no machinery.——North Star Mining Company, owners. P. Schuman of Mokelumne Hill, superintendent.

Ellen Vannan Drift Mine.—This is half a mile below the North Star Mine in Old Woman's Gulch, and on the same channel. It is opened through an inclined shaft 195 feet deep. Six men are employed.——W. J. Jackson et al. of San Andreas, owners.

Green Mountain Mine (Hydraulic and Drift).—This mine was being operated by hydraulic process with success during the spring of 1900, under permit of the United States Débris Commission, employing 12 men during the day only. From a portion of this claim there have been shipped, within the past two years, 12 tons of quartz crystals, for which this mine has long been famous. These were placed with Tiffany & Co. of New York, who estimated their value at about $18,000. Several handsome and absolutely perfect crystal spheres have been cut from the crystals obtained in this mine, but the limit of the size of a perfect sphere has thus far been about 5½ inches. A statement was made to the writer by one of the owners, that Mr. Tiffany had said that if a crystal could be obtained which would cut a sphere 7 inches in diameter, which should prove to be absolutely faultless and without a flaw, such a sphere would have a valuation of $30,000.——J. E. Burton et al., owners. J. McSorley of Mokelumne Hill, superintendent.

Emery Hydraulic Mine.—Also known as the Rose Hill. One mile from Mountain Ranch. This mine is situated on a branch of the Fort Mountain channel. It was being operated in the spring of 1900 with 800 inches of water, and two monitors working twenty-four hours daily, two pits having been opened. No work was in progress in the south pit. The work in the north pit is being carried down stream, a long tunnel having been cut for drainage. The water pressure at the upper

pit was 300 feet, at the lower pit 400 feet. The company owns $2\frac{1}{2}$ miles on the line of this channel. The bank has averaged thus far about 20 feet in height. From 2000 to 2500 yards are moved every twenty-four hours, when a full head of water is available. The owners have spent a large sum of money in perfecting their water-system, consisting of reservoirs, ditches, pipe-lines, etc. In the mine 10 men are employed; 15 on other work.——Emery Gold Mining Company of Mountain Ranch, owners. Earle C. Emery of Mountain Ranch, superintendent.

San Domingo Hydraulic (*Jupiter*) *Mine.*—This property was being worked in May, 1900, with two giants using 1500 inches of water under 150 feet head. The average of the season is estimated to be 1.25 yards per day per inch of water employed. The bank is nearly 100 feet high; the gravel is loose, and disintegrates rapidly under the powerful streams from the giants. The flume at this mine is 4 feet in width, 3000 feet long, and set on a 4-inch grade. The company owns about 2 miles on the channel.. There are 8 men employed.——The San Domingo Gold Mining Company, Parrott Building, San Francisco, owners. A. B. Thompson of Angels, superintendent.

French Hill Quartz Mine.—This is a prospect situated on the slope of the famous French Hill, about half a mile east of Mokelumne Hill. A cross-cut tunnel is being driven, which in March was in 400 feet. There are 5 men employed.——J. E. Burton et al., owners. T. E. McSorley of Mokelumne Hill, superintendent.

Satellite Copper Mine.—This property is near Campo Seco. When visited in the spring, the inclined shaft was down 250 feet, and sinking. The hoisting is being done by means of a gasoline engine, which appears to give satisfaction. At this mine an 80-ton water-jacket furnace was found in full blast, operated by what is known as "partial pyritic smelting," under the direction of E. J. Fowler, metallurgical engineer. The furnace is of special design, constructed from plans made by Mr. Fowler, in which 80 tons of material are treated daily, of which 50 tons are ore, the remainder being flux. The charge consists of raw ore, roasted ore, slag, limestone, and low-grade matte. In what proportion these are charged was not learned. Mr. Fowler says that this method of pyritic smelting is entirely feasible and successful on ores of this class. The ores are chalcopyrite and pyrite. A little zinc is occasionally seen. The ore contains but little silica, and quartz is brought from the croppings of neighboring veins for flux.——The Pennsylvania Manufacturing Company of Campo Seco, owners. A. C. Harmon of Campo Seco, superintendent.

Borger Copper Mine.—Near Campo Seco, and in the principal mineralized zone of the district. A new shaft is being sunk on a promising copper vein by Mr. C. Borger of Campo Seco.——C. Borger, owner.

Union and Keystone Copper Mines.—They are at Copperopolis, and comprise a mile of locations on the copper belt. The mines were worked extensively in former years, and produced a large amount of copper. The principal workings are down to a depth of 800 feet. The mines were closed down in 1893, and have since remained idle. They were unwatered in March, 1900, but further than this active operations have not been resumed.——Union Copper Mining Company of Boston, Mass., owners. G. McM. Ross of Copperopolis, superintendent.

Lightner Mine.—This is 2 miles southeast of Copperopolis. It has a strong iron gossan, which occurs in amphibolite schist. It is developed by several adit tunnels and shallow shafts. The ore in the oxidized zone is essentially gold-bearing, but being in the copper belt it is anticipated that in greater depth in the sulphide zone more or less copper sulphide will be found. The mine has no machinery.——Mr. Uren of Alameda, Cal., owner. Mr. Lillian of Copperopolis, superintendent.

Royal Consolidated Gold Mine.—This is in Salt Spring Valley at Hodson, 3 miles northwest of Copperopolis. Since the last report this property has been extensively developed under new management. The former operators worked a vein which dipped to the eastward at a low angle, and confined themselves to the defined limits of the walls of that vein. The quartz occurred in a series of large lenses in a dike of diabase. There are a number of nearly vertical transverse veins which come down from the hanging-wall, intersecting the flat vein and passing into the foot-wall, but, strange to say, no attention was given these steeply inclined veins by the former management. The present management, however, undertook the exploration of the mine upon broader lines, extending raises into the hanging-wall and sinking winzes into the foot, with the result that large deposits of payable ore have been developed both above and below the original Royal vein. In this mine may be seen some of the largest stopes in the State. The mine is almost absolutely dry, some of the stopes being dusty. Comparatively little timber is employed in sustaining the ground, and in view of this fact the lack of substantial pillars is the cause of comment among visitors. Although this ground is among the best to "stand" of any I have seen in this portion of the State, there is a limit to which this method of mining may be carried with safety. A system of timbering and filling must soon be inaugurated to avert disaster, as well as to recover the large ore reserves in sight in this mine. The shaft has been sunk to 900 feet from the collar, and the lateral development is extensive. The property is equipped with a large steam hoist and a 40-stamp mill. There are 100 men employed.——Royal Consolidated Mines (Ltd.), owner. J. C. Kemp van Ee of Hodson, manager.

The Royal Mill.—The mill of 40 stamps is under the direction of J. S. Shepard. In the old mill the 20 stamps weigh 850 pounds. In the new addition to the mill 20 stamps weigh 1150 pounds each. The old stamps drop 6½ inches, and the new 5¾ inches, 104 times a minute. No. 1 punched tin screens (24-mesh) are used. The discharge is 4 inches high, and is maintained closely to this by the use of ½-inch slats beneath the chuck-block. The capacity of the mill averages 3½ tons per stamp daily. The 20 heavy stamps of the mill crush about 14 tons more in twenty-four hours than the light ones. It may be interesting to state that the capacity of this mill is determined by weighing every car of ore that goes into the mill. There are 8 Wilfley, 3 Johnson, and 1 Frue concentrators. The pulp from the Wilfley machines and also that from the Frue is recleaned on two Wilfley machines. The pulp from the Johnson concentrators is also sent over the Wilfley machines. This is a very unusual arrangement of concentrating tables, but is stated to work very satisfactorily, producing clean concentrates. At present the sulphides are sent to Selby's reduction works. The company has under consideration the construction of an additional 60 stamps and a chlorination works at the property.

TUOLUMNE COUNTY.

Since the last report was issued by the Mining Bureau in 1896, Tuolumne County has been the field of unusual activity in mining operations. Encouraged by the success of the Rawhide, Golden Gate, Black Oak, Jumper, and other important properties in this county, many new enterprises were inaugurated, and during the years 1897, 1898, 1899, Tuolumne County was giving employment to a large number of men; but, as has been the case elsewhere, some of these investments have thus far proven unremunerative, and in a few instances the propositions have been abandoned permanently, though in other cases suspended operations will doubtless be resumed. A light rainfall through several successive seasons has caused a shortage of water-supply, which has also seriously affected the mining industry in this county, more so, apparently, than in the neighboring counties, for at this time mines which have been steadily operating for years are shut down owing to lack of water for power. As an offset to this unfortunate condition is the fact that several of the mines which have been in process of development are proving valuable properties, and will form welcome additions to the list of active producing mines of the county. Notable among these are the Eagle-Shawmut near Jacksonville, and the Densmore near Columbia.

There is considerable activity in the districts of smaller mines on the East Lode, and reports of good new properties in that region may be anticipated. There still remains a large territory unexplored in Tuolumne County, both on the Central Lode and on the East Belt. Besides these there are mines of known merit in the Sierras which must ere long attract the attention of capital. Passing southward from Calaveras County into Tuolumne at Robinson's Ferry, the Central Lode is found to continue in an almost unbroken line to the southern boundary of the county and beyond into Mariposa. There is a slight break in its continuity near Tuttletown, and another break of about 1000 feet between Whisky Hill and the Dutch Mine, and still another near the foot of Priest's Hill on Moccasin Creek. There may be other interruptions in its continuity, but the instances mentioned are the most noticeable. In fact, the lode is practically continuous through this county; and, as elsewhere, it is characterized by its massiveness and distinguished by the persistent occurrence of massive quartz croppings and broad zones of ankerite. Some of the most important mines on this lode are found, not in this belt of ankerite and quartz, but in amphibolite schist on the

hanging-wall side of the ankerite zone. The Jumper and Eagle mines are notable examples. The East Lode in Tuolumne County occurs in the grano-diorite and slates. An intermediate belt lies between these two lodes, in which occur numerous pocket mines in greenstone, slate, and limestone. Mines of this class are prominent in the vicinity of Sonora and near Big Oak Flat.

Bown Mine.—This is the first mine in operation on the Central Lode south of the Stanislaus River. It is half a mile from Robinson's Ferry, and 2½ miles northwest of Tuttletown. A shaft had been sunk (June 27th) to a depth of 630 feet at an angle of 64 degrees. The vein, which was being developed, is 10 feet wide and lies underneath the ankerite zone, the foot-wall being schist and serpentine. The vein has a sinuous course and a banded structure, containing gold and auriferous pyrite. The shaft is in the foot-wall, the vein being reached by cross-cuts from the shaft at 200, 300, 400, and 600 foot levels. On the 400-foot level a cross-cut has been extended 128 feet beyond the vein into the hanging-wall. The property is equipped with steam hoist and a 20-stamp mill, in which are 8 Union concentrators. There are 20 men employed.——Bown Mining Company of San Francisco, owner. W. J. Rule of Tuttletown, superintendent.

Jackass Hill.—Half a mile south of the Bown and east of the ankerite zone are the pocket mines of Jackass Hill, the most important of which are the Karrington and Stenchfield. This property is worked by several sets of leasers, who pay to the owner a royalty on all gold taken out. The mines are reported to have been regular and large producers for several years past. James Gillis of Sonora, owner.

Norwegian Mine.—It is 1 mile north of Tuttletown, overlooking the cañon of the Stanislaus.

Arbona Mine.—It is at Tuttletown, about ¼ mile east of the ankerite zone, in greenstone schist. The vein is from 3 to 10 feet wide, and is developed by a shaft 540 feet deep, and sinking in June. A 200-foot cross-cut tunnel intersects the shaft at 135 feet from the surface. Levels are run at 100, 200, 300, and 400 feet. The ore consists of massive quartz and pyrite. The mine is equipped with steam hoist and 10-stamp water-power mill. There are 12 men employed. This mine was worked many years ago by French people, who undertook to crush the rock in arrastras, but the quartz was found too hard to crush readily, and it had remained idle for years when the present owners renewed operations.——Equitable Mining and Milling Company of Stockton, owners. W. E. Brooks of Tuttletown, superintendent.

Rawhide Mine.—This property, 3 miles north of Jamestown, which for several years past had attracted much attention by reason of its large

and continued output, has within the past year been involved in litigation among the co-owners, and when visited very little information was obtainable, probably owing to pending lawsuits. The property was in operation, however. Usually about 100 men are employed. The surface plant consists of a large hoist, a 40-stamp mill, and chlorination works. ——Ballard, Martin & Nevills of San Francisco, owners.

Harvard (*Whisky Hill*) *Mines.*—These are a half a mile west of Jamestown, on the dolomitic zone, though the development of pay rock is principally in a zone of amphibolite schist on the hanging-wall side of the dolomite. There are two vertical shafts—one of 500 and one of 750 feet depth. These are connected by the 500-foot level from the south shaft. The veins of pay rock consist of silicious amphibolite schist of variable width up to 35 feet. The hanging-wall is amphibolite schist, hard and firm, not gold-bearing, or only slightly so; the foot-wall is serpentine. Hundreds of feet of levels have been driven in the ankerite zone, but the values are chiefly in the zone of greenstone schist. On the 500-foot level a cross-cut has been driven westward to the massive quartz vein, probably the downward extension of the "bowlder" vein seen on the surface. This cross-cut develops nothing of value. The property is equipped with steam hoists at both shafts, and a 60-stamp mill which is run by electricity. The mill has both Johnson and Dodd tables, which effect a clean concentration of the sulphides. A series of cyanide experiments is to be made, with a view to treating the sulphurets by that method. The apron and sluice plates are 6 feet wide, divided by a longitudinal strip down the center. The plates have a grade of $1\frac{1}{4}$ inches to the foot. Thirty stamps were dropping at the time of my visit. There are two electric motors in the mill, each of 75 horse-power, each motor being calculated to run 30 stamps.——Harvard Gold Mining Company, owners. J. P. Munger of Jamestown, superintendent.

Dutch Mine.—It is at Quartz Mountain, and has been in continuous operation since 1893. The shaft has reached a depth of 1200 feet, inclined at 58 degrees. There are ten levels in the mine. The development is chiefly upon a zone of ankerite and mariposite 60 feet in width, in which are many veins and lenses of quartz, bearing gold and auriferous pyrite, though in greatly varying quantities. The pay zone is usually found on or near the foot-wall side of the ankerite zone. The foot-wall country consists of amphibolite schist, gabbro, tufaceous slates, Mariposa clay slates, serpentine, and diabase. These are distributed somewhat irregularly. The hanging-wall side is principally amphibolite schist, so far as could be observed. The pay shoots appear to cross the ankerite zone from foot to hanging wall diagonally, the intervening blocks of ground being much lower in grade. There is also a noticeable series of slips in the mine, which show that the hanging-wall side of the zone has in each case been forced upward. These slips

like the schists dip easterly, but flatter than the schists. Northward on the surface the ankerite extends for a distance of 1000 feet, then disappears beneath the alluvial of the valley, but considerable rock-exposures occur farther northward, and it is observed that the ankerite vein is not continuous to Whisky Hill. There is an interval of not less than 1500 feet in which it cannot be found, though reappearing on the north side of Woods Creek at the south end of the ridge known as Whisky Hill. The Dutch Mine is equipped with a large steam hoist, the compressor and mill of 20 stamps being run by electricity. There are 54 men employed. A cyanide plant was being constructed early in July to work the sulphides concentrated from the ores.——Dutch Mining and Milling Company of San Francisco, owners. Albert Trittenbach of Quartz Mountain, superintendent.

The App and Heslep Mines.—These join the Dutch Mine, and are situated on the northern end of Quartz Mountain. The vein consists of a large mass of ankerite and quartz, with a black slate hanging and diabase foot-wall. The main shaft is down 1000 feet, equipped with water-power hoist. The mill has 20 stamps, and was in operation during midsummer. There are 25 men employed.——The App Consolidated Mining Company of San Francisco, owner.

Santa Ysabel Mines.—These occupy the southern end of Quartz Mountain, comprising several claims of irregular shape and size. The property was idle at the time of my visit, but it was reported that operations were to be resumed.——Santa Ysabel Mining Company of Boston, owner. E. A. Hardy of Quartz Mountain, in charge.

Jumper Group of Mines.—This property is situated on a low ridge half a mile south of the village of Stent, and comprises the Golden Rule, New Era, and Jumper mines. The Jumper is the principal mine, and is being systematically worked. The Golden Rule has a large amount of development, as has also the New Era, the latter chiefly through the medium of levels extended into it from the Jumper. The general structural geology of the mine is not wholly unlike that of other mines in the neighborhood. A cross-section taken in the Golden Rule in a long cross-cut gives a good general idea of the geological structure. Through the entire length of the hill the ankerite vein is prominent, with the usual accompaniment of large quartz lenses; all of this rock is very low grade in gold, however. The foot-wall country is diorite, separated from the ankerite zone by a dike of serpentine of variable width (about 100 feet). The ankerite is divided into two zones by the intrusion of a large dike of diorite similar to that forming the west country. East of the ankerite zone is a succession of diorite and diabase dikes, which in part are altered to amphibolite schist, and it is in this schist that the pay zone is found. Easterly from this the formation is amphibolite schist,

with dikes of granular diabase. This zone of schist is over 1000 feet wide. In the Jumper Mine the gold occurs in a dike accompanying the schistose zone, and in small veins and veinlets of quartz and calcite, scattered irregularly, but always within certain definite zones, the outer limits of which form the walls. The width of this zone varies from 4 or 5 to about 30 feet. In its earlier history an effort was made to work the mine by selection of the better from the poorer portions, but owing to the peculiar geological conditions obtaining the present manager deemed this method unsuited to the accomplishment of the best results, and the method of selection was abandoned for that of stoping everything between the walls. This might at first appear like an extravagant and unnecessary course to pursue, but the results have proven eminently satisfactory. The Jumper is one of the best worked and best managed mines in the State. It is heavily and properly timbered. The walls are hard—that is, there is no trouble from swelling ground. The main shaft is down 1285 feet, and is equipped with air and electricity. Power drills are employed. There are nine levels in the mine. The mill has 60 stamps, and has no concentrators, except one for experimental purposes. There are 125 men employed.——Jumper Gold Syndicate of Glasgow, Scotland, owners. M. D. Kelly of Stent, superintendent.

The Eagle-Shawmut Mine.—This property is 1 mile north of Jacksonville, on the ankerite vein. Its distinguishing feature is the line of massive quartz outcrop which forms great, wall-like masses along the course of the vein. The hanging-wall country is amphibolite schist; the foot-wall is slate. The principal developments of the mine consist of a cross-cut tunnel driven 1100 feet through the foot-wall country to the vein, and a shaft sunk at the tunnel level to a depth of 660 feet on the vein. The ankerite zone contains veins or lenses of quartz, which carry gold in paying quantities, besides which there is a broad zone of amphibolite schist on the hanging-wall side, in which is a gold-bearing shoot. This rock contains 2 or 3 per cent of auriferous sulphide, and is one of the most important developments thus far made in the mine. The superintendent, Mr. Charles E. Uren, has introduced what appears to be an excellent system of stoping and filling in this mine. His plan is to put a long raise to the surface from a point above the tunnel level. This raise is driven at an angle of about 65 degrees above the horizon, the slope being westerly. The formation and veins dip easterly at about 70 degrees. The walls are usually firm and hard. The incline above mentioned reaches the surface in an open cut, where the rock (being barren) is suited for filling, and may be quarried cheaply. Stopes are started and mining operations continued by cutting out the ground the full width of the vein in the form of the letter "A", the base being longitudinally of the vein and the angle at the apex being no less than 90 degrees, in order that rock may readily run on the slope. The floor of this

stope is heavily stulled and covered with lagging. The winze passes directly through the apex of this triangular stope, and waste is sent down from the surface and the excavation filled. Stoping then progresses in "slices" on alternate sides of the winze or raise. These slices are from 15 to 20 feet in height, the pay rock passing down through mill-holes cut through from the level below, the ore-chutes being carried up by cribbing, keeping even with stoping operations, and the filling run in first one side and then the other, until the block is worked out. The levels below are worked in similar manner, the filling passing through the stationary loading chutes (at the levels) and across the track into the next winze beneath by use of an apron, which may be removed when desired until again required. This method demands a minimum amount of timbering and renders the mine safe as far as caves are concerned. It may be elaborated and extended from level to level and make available a large amount of ore at low cost of mining. In addition to the ore deposits above referred to there is upon the surface a zone of amphibolite schist, which contains a finely disseminated gold. Experiments have proven that this rock is amenable to the cyanide process. The mine is equipped with a 40-stamp mill, in which are 17 concentrators—Frues and Unions. The hoist is run by water power, and at present is situated near the inner end of the long tunnel. It is planned to raise the shaft to the surface. The mine and premises are lighted by electricity. Ore is sent out of the mine in long trains of cars hauled by a horse. The cyanide plant has a capacity of 56 tons daily, a percolation plant of 50 tons, and an agitation plant of 6 tons. A chlorination plant was in course of construction in July. There are 100 men employed.——Charles E. Uren, superintendent.

Republican Mine.—It is ½ mile from Jacksonville, and comprises a group of claims on the main lode, the principal ones being the Republican and Mammoth. The principal ore-shoot thus far developed is from 2 to 8 feet in width. There remains much of the hanging-wall country to explore, however, and satisfactory developments may be expected in that direction. A tunnel has been run 750 feet through the foot-wall country of the Mammoth claim to the vein, and a shaft sunk in the tunnel 430 feet. The main shaft in the Republican is down 400 feet, with four levels opened. The company has a mill of 10 stamps at the mouth of the Mammoth tunnel, though at present operating only the Republican, the ore being hauled by wagons. The mill has 4 Frue vanners. A large air-compressor is situated at the mill, a pipe-line running to the Republican shaft for the purpose of operating air drills. The mill and compressor are run by water power, the company owning a ditch and flume several miles in length; but owing to a scarcity of water the past three years, this power has not been available during the summer and fall months. The hoist at the Republican is

run by steam. Water is removed from the mine by means of a valve bucket, which discharges automatically upon reaching the surface. This is accomplished by means of a tipple. The bucket is hoisted until it reaches a section of the skidway, which is movable, being secured in place by a strong iron rod passing through this section at a point somewhat above its center. Being brought to a state of rest, the weight of the bucket and contained water causes the tipple to move from an inclined to a vertical position, the bucket being then let down until the center pin of the valve in the bottom resting upon the floor of the water-dump causes it to discharge its contents, which flow away; a counter weight upon the tipple causes it to resume its normal position, carrying with it the empty bucket, which may then again descend into the mine. There are 22 men employed.——Republican Mining Company of San Francisco, owners. T. F. McGovern of Chinese, superintendent.

Clio Mine.—This is ½ mile south of Jacksonville. It has recently been equipped with a new steam hoist and a 10-stamp mill, the boilers (generating steam for both hoist and mill) being located at the mill several hundred feet distant down the hill from the hoist. A shaft had been sunk 170 feet about the middle of July, at which time the mine was not in operation, all the work in progress being at the mill, which was in course of construction.——J. E. Potter of Jacksonville, owner and superintendent.

Southward from the Clio, no mines are in operation on the Central Lode in this county, excepting some prospecting in one or two mines.

Golden Gate Mine.—It is 1 mile southwest of Sonora, and is one of the principal mines of this county. It has been in continuous operation for ten years, and has been a large and steady producer. The formation is amphibolite schist, striking N. 10° E., dipping to the eastward. Through this the Golden Gate vein strikes about N. 60° E. The strike is somewhat variable. The dip also varies from 35 to 65 degrees. Thus the vein does not conform in either strike or dip with the inclosing formation. At three points in the underground workings of the Golden Gate Mine I found veins of quartz coming in from the hanging-wall side of the Golden Gate vein. One of these appears on the 200-foot level, 500 feet in a northeasterly direction from the shaft. This vein is from 6 to 8 feet in width, showing no indications of value. This vein has an apparent dip to the eastward of 50 to 65 degrees. It does not cross the Golden Gate fissure, but stops at the hanging-wall. Another instance of the occurrence of a vein in the hanging-wall is found on the 300-foot level, 450 to 500 feet northeast of the shaft of the Golden Gate. Here is found a large stope with intermediate levels—one 20 feet above, the other 25 feet below, the 300-foot level. The mineral zone of the Golden

Gate Mine is here large, and the stopes are wide. At the point indicated a vein having a strike parallel with the Golden Gate fissure with a dip of 40 degrees to the northwest cuts completely through the Golden Gate fissure, passing into the foot-wall. This vein is about 2 feet in width. It shows no sign of valuable mineralization, and has not been worked, excepting where it intersects the stopes of the Golden Gate Mine.

One other instance of the occurrence of a vein of quartz from the direction of the hanging-wall is found on the 400-foot level, where a small vein about 1 foot in width intersects the Golden Gate vein, passing into the foot-wall. It is perpendicular, and cuts the Golden Gate vein near a right angle; it shows no sign of value.

On the 500-foot level the main drift diverges, the hanging-wall branch following a gouge and the foot-wall branch following a small lens of ore. Thirty feet from the point of divergence in the foot-wall branch is a cross-cut extending nearly 100 feet into the foot-wall, all in the hard greenstone, with no ore.

The principal shaft is down 700 feet, with a winze 200 feet below the 700-foot level at a point some distance northeast of the shaft. There are ten levels in the mine, three of which are above the collar of the shaft. Considerable development was in progress in these upper levels, some excellent ore being found. The property is equipped with hoist and 20-stamp mill, and has electric, steam, and water power. There are also a slimes plant and a chlorination works attached to the mine. Joseph Francis, who is foreman of the mine, has invented a simple device in the form of a swinging apron of iron for use on loading chutes, by means of which the chutes may be constructed so as to require less room than they usually do, the apron being turned upward or allowed to hang beneath the chute when not in use. The employment of these simple devices not only results in convenience, but also effects a saving of time and money. There are 70 men employed.——Golden Gate and Sulphuret Mining and Development Company, owner. J. Fisher of Sonora, superintendent.

Densmore Mine.—It is 3 miles northwest of Columbia, overlooking and partly in the cañon of the Stanislaus. The mine was discovered many years ago, but was developed in a superficial manner by the owner, who was unable to do more than assessment work on it. No one considered it of more than nominal value. Within the past two years, however, it has changed ownership a number of times, and it is being developed systematically. The formation is grano-diorite, and it is pertinent to here remark that, regardless of the prejudice in the minds of some against granite as a yielder of profitable ore-bodies, some of the deepest and best mines in California, as well as elsewhere, are in granite or grano-diorite. On the Densmore a tunnel has been driven on the vein a distance of 400 feet and a shaft sunk 400 feet from the surface, inter-

secting the tunnel. This is at present the principal development and has exposed an ore-shoot 200 feet long, 400 feet high, with an average thickness of about 5 feet. In places it is 12 feet wide. This ore, it is stated, will average $17 per ton. Some portions are heavily sulphuretted, and run from $150 to $250 per ton. Of this, former owners shipped during 1899–1900 over $26,000 worth, net. In addition to the above described development there are several other tunnels, shafts, winzes, etc. A main tunnel was being driven 200 feet lower than the one above referred to, which will deliver ore into the bin of the mill, which consists of two batteries of 2 stamps each, with one Wilfley concentrating table. A cyanide plant of 10 tons daily capacity also forms part of the equipment. Though in a rugged cañon, the mine is favorably situated for economic working, by means of adits, which will command over 600 feet of backs, and then another tunnel may be driven still lower if desired. A ditch owned by the Utica Company passes along the mountain side opposite the mine, and will afford a cheap power; and, taken altogether, it is one of the most favorably situated mines in the county. There were 20 men employed the latter part of June.——Hayward & Lane of San Francisco, owners. L. R. Poundstone of Columbia, superintendent.

Confidence Mine.—It is 12 miles east of Sonora, at an altitude of about 4000 feet, in the granite area lying east of the Calaveras formation. This is one of the most noted mines in the county, and has been worked for years, producing, it is claimed, upward of $5,000,000. The vein strikes N. 14° W., and dips east at 18° to 30°. The inclined shaft has reached a depth of 810 feet, with a winze 200 feet below the 800-foot level. The mine makes less than 60 gallons of water a minute. The vein varies from a few inches to 15 feet in thickness. The granite is much decayed from the surface to a depth of 300 feet, below which is found a hard, normal grano-diorite. A light-colored dike rock, frequently of pale-green color, due to chlorite, is usually an accompaniment of the vein. The ore is free milling, but contains a sulphide mineral difficult to concentrate. Cyanide experiments are being made on this mineral and also on the coarse sands which are separated from the tailings by means of a form of spitzkasten. Seventy per cent of the material is coarse sand, containing 95 cents per ton. The remaining material goes to a Gates canvas plant. The total loss in tailings is $1.65 per ton. The slimes below the canvas tables still contain $3 per ton. This is the material to be experimented upon with the cyanide process, but, due to its extreme fineness, the percolation method cannot be employed. The property is equipped with a steam hoist and 30-stamp mill, of which 20 were dropping. A No. 24 punched tin screen is used, the discharge being from 7 to 8 inches high. The capacity is 3 tons per stamp. There are 3 concentrators with 6-foot belts, and 4 with 4-foot belts. Tailings are run onto the canvas tables 9 hours before purifying. The experi-

ment of purifying was tried, but proved unsatisfactory.——Confidence Gold Mining Company of San Francisco, owners. N. Carmichael of Confidence, superintendent.

Black Oak Mine.—It is ½ mile southwest of Soulsbyville, on the East Lode, and includes the Black Oak, Carra, and Live Oak claims. The mine was discovered about thirty years ago, and during its early history gained little fame, but within the past five years it has come to be recognized as one of the most important mines in the State. It occurs in grano-diorite. The vein varies from 1 to 25 feet in width, and has several branches coming in from the hanging-wall side. These latter often contain heavy sulphide mineral of high grade. Thousands of tons of this class of ore have been shipped to Selby's. The deepest shaft is down 900 feet, at an angle approximately 65 degrees, the dip being westerly and the strike north and south. The vein is intersected at intervals by dikes of very hard dark-green diorite. These simply displace the vein. One at the northern end is evidently in the plane of a fault fissure, as the vein does not reappear on the north side of the dike, as in previous instances farther southward. The throw is presumed to be to the westward. If this assumption be correct, the Genevieve Mine, lying about 4000 feet to the northward, may be the real extension of the Black Oak vein. The mine is equipped with steam and water-power hoist and a 30-stamp mill. A large slimes plant also forms an important feature in the beneficiation of the ores. The ores are quartz, containing iron, copper, lead, and zinc sulphides. Pyrrhotite, a magnetic iron sulphide of bronze color, is a prominent constituent of the ores, and is characteristic of the granite veins on the East Lode. In the mill a 60-mesh screen is in use, the discharge being 6 inches high. The 30 stamps crush 35 tons daily, which is an unusually low duty for stamps in California, but is probably due to the hardness of the rock and the fineness of the screen. The management claims to be able to make a higher saving by fine crushing. There are 10 concentrators in the mill. The pulp from the batteries passes to the plates and thence to the vanners. Forty per cent of the gold is saved in the batteries. From the vanners all tailings go to the canvas plant, consisting of two floors 60 x 100 feet. From the canvas tables the pulp is elevated and sent to the cyanide vats, where it is charged by means of a mechanical device to insure an equal distribution of sands and slimes, and to prevent as far as possible the formation of channels in the charge. The pulp is treated by the percolation method for 80 hours, and then discharged through the side doors into the creek. A 60-ton tank is sluiced out in one hour with water under a 500-foot head. Sulphurets obtained from the vanners and from canvas tables are worked in a separate plant by agitation for a period of 36 hours, with an extraction of 94 per cent. The strength of cyanide solution employed on the tailings

is 0.25 per cent; that in the agitation process varies somewhat according to the value of the ore. There are 50 men employed.——Scott, Dow & Co., owners. W. P. Scott of Soulsbyville, superintendent.

Eureka Con. (*Dead Horse*) *Mine.*—It is on the East Lode, at Carters. The deepest shaft is down 1550 feet. The formation is mica schist of the Calaveras formation. The vein is from 1 to 12 feet wide, and consists of quartz and pyrite. The hoist and mill are run by water when available. The mill has 20 stamps of 900 pounds weight. There are 8 Frue concentrators in the mill. Formerly a canvas plant was operated in connection with the mill, but its use has been discontinued. A cyanide plant on the property treats 2 tons of sulphides daily. This is on concentrates from vanners. The screen in the battery is 38-mesh. It is claimed that the extraction is about 90 per cent. There are 41 men employed.——Alvinza Hayward and Hobart Estate of San Francisco, owners. E. T. Kane of Carters, superintendent.

Providence (*Gloster*) *Mine.*—This property is 2 miles southeast of Carters, in the cañon of the North Fork of Tuolumne River. Since the last report this mine has come into prominence as a rich producer. It was systematically opened during 1896–97, and equipped with hoist and milling plant, to accommodate which expensive grading and road-making were required, as the slope of the mountain is nearly 35 degrees. A mile and a half of road, reaching from the bottom of the cañon to the mine, cost $5,000. The vein occurs in the black slates of the Calaveras formation, and will average 5 feet in width in the pay shoot. The quartz contains 1½ per cent of sulphides. The shaft is down 850 feet, with six levels. The mill has 10 stamps, but was not in operation in July last. Only development work was in progress in the mine. All power is steam, water being very scarce in that locality. There are 12 men employed, though the full force is 30 when the mill is in operation.——Tuolumne County Mining Company, owner. C. A. Holland of Carters, superintendent.

Goldwin Mines.—This constitutes a group of three claims about a mile westerly from the Providence Mine, and 10 miles southeast of Sonora. The elevation is about 2000 feet. The strike is north and south, and the dip east. Geologically, the property consists of a broad-fissured zone with a system of parallel quartz veins of variable width, from 2 to 5 feet. The veins are often found accompanied by a light-colored dike. The formation is a fine-grained mica schist. The quartz vein is usually banded, and contains auriferous sulphides. A tunnel has been driven 850 feet on the vein and a shaft sunk 250 feet, in addition to which there are several short tunnels and winzes. The property is equipped with a substantial hoist driven by air, and a water-driven air-compressor. The company has constructed a dam in the cañon and built a

flume to the mill site, thus having free water-power. It is reported that this property has produced $150,000. It had been idle for many years before coming into the hands of the present owners. There are 25 men employed.——Goldwin Con. Mines, owner. W. H. McClintock of Sonora, superintendent.

Dreisam (Easton) Mine.—It is on the East Lode, at Arrastraville. The vein is from 12 inches to 3 feet in width, and is in grano-diorite. A shaft had been sunk to 300 feet in July, and still sinking. The hoist is equipped with both steam and water power. The mill has two batteries of 6 stamps each, and two Frue concentrators. The mill is to be enlarged. There are 30 men employed.——Dreisam Gold Mining Company of San Francisco, owner. W. Morehead, superintendent.

Grizzly Mine.—It is 1 mile south of Carters, on the East Lode. The vein is 10 feet in width, has a banded structure in Calaveras slate, with the usual accompanying dike. The shaft is down 750 feet, with levels at intervals of 100 feet. The mill has 20 stamps, with 8 Frue vanners. Water furnishes power for both hoist and mill. From 16 to 20 men were employed in July.——Grizzly Mining Company of San Francisco, owner. W. R. Hall of Carters, superintendent.

Big Oak Flat District.—Since the last report there has been much activity in and near Big Oak Flat. A score or more prospects of greater or less prominence have been incorporated and a large sum of money expended in their equipment and development. As is usual in such cases, some of these have proven unsatisfactory and have been abandoned, while others are still developing, with fair prospects.

Longfellow Mine.—It is at Big Oak Flat, and is generally considered as being on the East Lode, though this section is really between the Central and East Lodes. The geology of the mine as described by the superintendent is as follows: There are two veins about 50 feet apart, the foot-wall vein being 10 to 12 feet wide and the hanging-wall vein 4 to 5 feet wide. There are many stringers of quartz in the slaty zone inclosed between these two veins. The formation is slate. A shaft had been sunk to 450 feet in July last. The surface equipment consists of a steam hoist and a 10-stamp mill, with Wilfley and Frue concentrators. A 30-ton cyanide plant was in course of construction the latter part of July, and the tailings are to be treated by that method. During the dry season water for milling is pumped from the Mississippi shaft sunk on a vein in the granite of Big Oak Flat.——Longfellow Gold Syndicate of Glasgow, owners. A. P. Dron of Big Oak Flat, superintendent.

Mack Mine.—This adjoins the Longfellow on the east, and is on the same vein. The shaft is down 430 feet at 35 degrees. Four levels are opened, and the prospect is stated to be encouraging. The mine had a steam hoist but no mill in the latter part of July. There are 12 men employed.——Mack Con. Mining Company of San Francisco, owner. C. L. Lang of Big Oak Flat, superintendent.

A Gold-Bearing Zone.—This is found about 1 mile west of Big Oak Flat, and extends for more than 15,000 feet along the mountain side, and presumably could be traced farther. The formation consists of a succession of black slates and diabase tuff. A description of the *Criss-Cross* claim will answer in a general way for all of the numerous claims along this belt for a considerable distance in either direction from it. In that property the formation consists of Calaveras slates, and reefs of diabase tuff. The slates occur in zones, some of which are relatively soft and contain disseminated iron sulphides. The remaining portion of the slates is usually hard, and less highly mineralized. The slates are also intruded by dikes of diabase and porphyry. There are developed in this mine four zones of what are termed by the miners "mineral or metallic slates." These zones are separated from each other by dikes of variable width, not exceeding 20 feet. The slates strike north 30° W., standing vertical. The entire formation is intersected by seams and veins of quartz, which strike about N. 30° E., dipping southeasterly at 60° to 70°. Some of these quartz veins, small at the surface, widen to 24 inches or more within a depth of 50 feet, and carry disseminated gold, proving that these are not exclusively pocket mines, as has been supposed. These vertical veins of quartz occur at intervals of 8 to 10 feet, having approximately a parallel strike. A second series of quartz veins is found lying nearly horizontal, cutting the slates, and intersecting the vertical veins. These veins occur at distances of 4 to 6 feet apart, dipping at a low angle to the westward, thus dividing the formation into rhomboidal blocks. Frequently at the intersection of these highly-inclined and flat veins a slight dislocation may be noticed, indicating that there has been some movement of the formation since these veins were formed. The gold found in this property is, as far as known, confined almost exclusively to the zones of "metallic" slates. In that portion of the property to the northward the steeply-inclined veins have been found to carry coarse gold in considerable quantity; in fact, to such an extent that many thousands of dollars have been taken from rather superficial development by pocket-hunters. To the southward, however, the gold in the veins has been found chiefly in the nearly horizontal seams and veins, and these have all produced largely. The cause of this difference in the occurrence of the gold has not yet been ascertained, but the fact that such is the case is of interest. As a result of the operations of the pocket-miners there has been accumulated in

the different dumps hundreds of tons of material, which, to the pocket-miner, is waste, but it has been found by repeated tests that all of these dumps carry considerable value in gold. It is an established fact that the slates on either side of vertical veins carry gold for a distance of 2 feet or more from the vein. This also seems to be the case with the horizontal veins. It may be that the gold-bearing zones constitute a milling proposition, and that not only the quartz veins, but the slates as well, may be mined and milled as a whole. In this respect these gold-bearing zones bear some resemblance to the Jumper Mine near Stent, in this county, where it has been found that the most economical, and withal the most successful method of operating is to mine all the material between the walls of the zone and the milling of all such material, there being practically no waste.

MARIPOSA COUNTY.

Since the publication of the last report of the State Mineralogist, Mariposa County has taken on more active life. The Mariposa Grant, covering an area of about 70 square miles, which for many years had lain idle, has become the property of the Mariposa Commercial and Mining Company, which has undertaken the active exploration and development of at least five of the most important mines on the Grant. They are going about this in a business-like way, and the indications are that if there is any actual merit in the mines on the Grant it will be ascertained by the present operators. A hasty visit was made to this field of operation in the latter part of May last for the purpose of investigating what had been done and what was expected of these mines in the future.

Mariposa Mine.—This property, worked many years ago, it is reputed at one period with great success, but which had been idle for more than thirty years, has been reopened, and an inclined shaft sunk which had reached a depth 475 feet on May 15th. The shaft was carried down at a uniform angle, but the vein passed out into the hanging-wall at about 400 feet from the surface. In cutting a station at 475 feet, the vein was discovered in the hanging-wall. The walls are diorite-porphyrite, and very hard. The vein has little or no gouge, but generally breaks free from the walls. The center of the vein is usually massive, with a banded structure near the walls, and in some portions the entire vein shows the banded structure. It varies greatly in width, from a seam to 12 feet or more. It strikes N. 70° W., with a variable dip to the southward, which will average about 60 degrees. Several hundred feet west of the new shaft a branch breaks into the foot-wall, striking N. 50° W. A shaft, now caved and filled with water, is sunk at the point of divergence. It is said that large amounts of gold were taken from this shaft in the form of pockets by the early miners. A report of Dr. R. W. Raymond, "Mineral Resources West of the Rocky Mountains," 1868, states that the Mariposa Mine was closed at that time, for the reason that mining operations were no longer profitable, though the rock contained nearly $10 gold per ton. It has been ascertained by careful sampling of the faces of the stopes abandoned years ago, that considerable bodies of rock were left, which averaged over $7 per ton, where the vein was from 2 to 4 feet in width. During the past summer a long drift on the 400-foot level has cut through a fine shoot of high-grade ore. The mine is equipped with steam hoist and air-compressor, steam pumps, and other

necessary machinery. There are 28 men employed.——Mariposa Commercial and Mining Company, owners, 320 Sansome Street, San Francisco. J. H. MacKenzie, Mount Bullion P. O., general manager.

The Princeton Mine.—This property, situated at Princeton, 6 miles northerly from Mariposa, has also been reopened after an idleness of many years. A new inclined shaft has been sunk to a depth of 600 feet, penetrating some little distance below the old workings, very little of which are at present accessible. Near the bottom of the shaft, two fine-grained, ash-colored dikes intersect the vein at an oblique angle. They have not "thrown" the vein, simply passed through it. In the bottom of the shaft, at the time of my visit, the vein was about 4 feet in width, of beautiful banded quartz. The entire vein from the surface to the 600-foot level is inclosed in the typical clay slates of the Mariposa beds. These slates differ very materially from the black tufaceous slates so closely associated with the rich ore deposits of Amador County, and to which more particular reference is made under the head of Amador County.

At this writing, the latter part of May, nothing more can be said of the Princeton Mine, and only the future development of the property can determine its real merit. The mine has an authentic record exceeding $3,000,000 to a depth of 600 feet. In the foot-wall country, lying immediately west of the Princeton vein, there are many veins, both large and small, of gold-bearing quartz, and this section it is the intention of the company to prospect. The mine is equipped with steam hoisting plant and machine shop, and a 10-stamp mill is being erected for the purpose of testing ores from the several mines of the Grant. The central office of the mines is located at Princeton. There are 30 men employed. In the middle of September the shaft was down nearly 900 feet, the vein averaging 3½ feet in width.——J. H. MacKenzie, Mount Bullion P. O., general manager.

The Josephine Mine.—This property is about 3 miles north of Bear Valley, overlooking the Merced River, and immediately adjoins the "Pine Tree," with which its name is usually associated. This is also being operated by the Mariposa Commercial and Mining Company. The manager has placed a hoist underground, and sunk a winze 200 feet from the level of the "English" trail drift. A vigorous policy has been inaugurated, and the vein will be developed as rapidly as possible. It has been stated in numerous previous reports that the Josephine vein splits off to the westward from the Pine Tree vein; that it continues upon an independent course for a distance of nearly 15 miles, rejoining the main lode near Piñon Blanco, 3 miles north of Coulterville. A careful investigation has led to the conclusion that the Josephine vein returns to and rejoins the Pine Tree vein within a distance of 3000 feet from

where it diverges, at what is called the old Fremont shaft. The error into which myself as well as others have been led was in presuming that a line of disconnected croppings represented the Josephine vein, whereas the croppings of the Josephine are absolutely continuous, and may be traced from its point of divergence from the Pine Tree northward to where it rejoins the Pine Tree vein. The hills are covered with a dense growth of chaparral, manzanita, and greasewood, and the tracing of this line of croppings was not an easy task, though not an impossible one.

Both the Pine Tree and the Josephine veins are well exposed on the level of the English trail drift, where, taking a cross-section at a point 437 feet below the croppings at the Fremont shaft, it is found that the two veins converge on this level about 400 feet north of the point of meeting on the croppings, showing that the line of convergence is not vertical, but inclined to the northward. A cross-cut at the point where these veins converge on the English trail level, shows a body of quartz 40 feet in width, dipping uniformly to the eastward at an angle of 60 degrees. Along the drift which follows closely the Pine Tree vein, the two great veins are separated by a mere seam no thicker than a knife-blade. Northward, a mass of soft material composed of ankerite with mariposite and quartz, separates the veins by a few feet. Still farther northward the divergence is greater, and the Pine Tree vein shows a gouge 1 inch thick on the hanging-wall side of the vein. A cross-cut has been driven 25 feet eastward through a mass of crushed and highly altered ankerite to a second gouge containing fragments of this rock-mass. The gouge is from 1 to 2 inches thick, and is extremely tough, but soft. The wall beyond is polished like a mirror, and was formerly considered the hanging-wall of the vein. The material beyond the slip is identical with that in the cross-cut (crushed ankerite altering to talc). Serpentine occurs on the hanging-wall side of the vein on the surface over 200 feet distant. The serpentine approaches nearer to the vein, going northward, however, and in the tunnel driven near the Merced River, about 1000 feet lower than the English trail drift, lies on the hanging-wall side of a zone of material similar to that found in the cross-cut above referred to (the altered ankerite). The ankerite, containing mariposite, separates the Pine Tree and Josephine veins, and the material grows broader as the veins diverge, but where they are 80 to 100 feet apart and more, it does not fill the entire space between them—a gray rock, amphibolite schist, lying next the ankerite.

The Josephine vein is distinguished everywhere along its course by what may be termed its fragmental appearance. A banded structure is frequently apparent, but mixtures of quartz and black slaty material are the most persistent features.——J. H. MacKenzie, Mount Bullion P. O., general manager.

Croppings of the Mariposa Vein.

Croppings of the Louisa Mine, Coulterville, Mariposa County.

Pine Tree Mine.—This adjoins the Josephine, and is 3 miles north of Bear Valley. One of the old tunnels driven by the former operators has been cleaned out and retimbered, and a hoisting engine set up underground about 600 feet from the mouth. Here a shaft has been sunk to a depth of 300 feet below the level. Ventilation is secured by an upraise through old workings above the hoist connecting with an upper tunnel. The engine is operated by steam carried in from the boilers at the mouth of the tunnel, the exhaust passing out through the raise. Owing to the careful manner in which the steam pipes have been packed, there is little condensation in the pipes, and the temperature at the station is

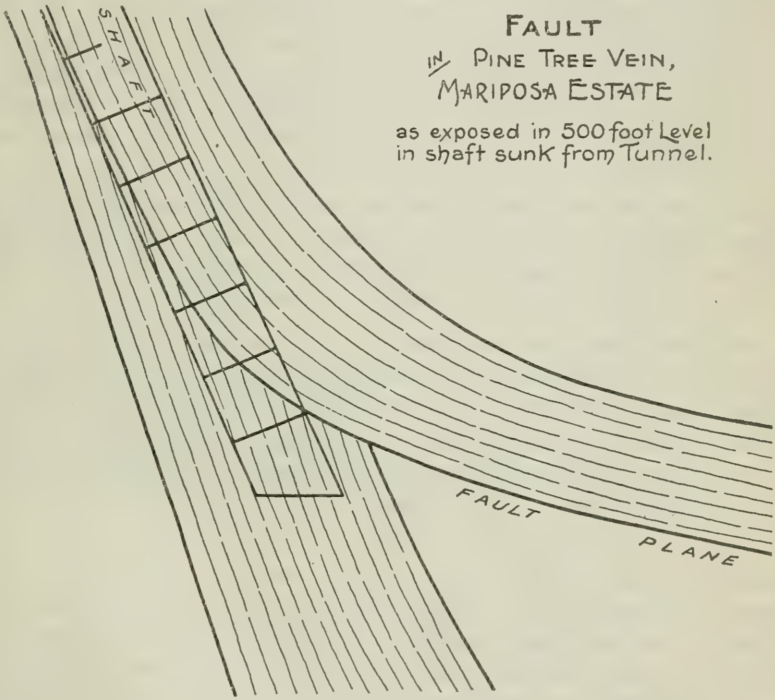


Fig. 35.

not uncomfortably warm. In sinking the shaft, a very interesting fault was discovered about 300 feet from the platform, the character of which is illustrated in the accompanying drawing (Fig. 35).

The indications are that the formation on the hanging-wall side of the fault has slipped downward, and that if sinking were continued on that portion it would be found to cut out, though in what distance it is impossible to say. The foot-wall portion, however, will extend downward to indefinite depth. The shaft is being sunk through the heart of the ore-shoot opened by the old company, it being the purpose to ascertain as quickly as possible whether payable ore still remains in the

mine, and if so, how much. The Pine Tree Mine is everywhere characterized by its massiveness and its entire freedom from slaty inclusions Iron pyrite occurs in the quartz, but is not abundant. The vein is usually well defined by smooth walls, the foot-wall being always, as far as observed, mariposite and ankerite. The hanging-wall side of the quartz vein is a granulated mass of rock, containing many fragments of what appear to be the ankerite. The real hanging-wall—normal country rock, i. e., slate, diabase, or serpentine—has not been cut on the English trail level. At the mouth of the old Pine Tree tunnel, now caved and inaccessible, the serpentine is found close to the vein. Southward, up the hill, it is fully 200 feet away from the vein. In the river tunnel the serpentine forms the hanging-wall of the vein—that is, it lies on the hanging-wall side of the fragmental rock (crushed ankerite) referred to as occurring on the hanging-wall side of the quartz on the English trail level. In the river tunnel the Pine Tree vein splits up and makes good-sized quartz veins in this fragmental material. In places the quartz is confined to the foot-wall side, ranging in width from 4 to over 40 feet. In speaking of the vein the entire mass of ankerite with the included quartz lenses is meant, though commercially only that portion containing pay ore would be recognized as the vein.

Roma and Sierra Blanca (Quartz).—Three miles northeast of Colorado. A tunnel is being run 1400 feet to reach the vein. It had reached a length of 915 feet September 1, 1900, and is being driven through soft slate and schist at a cost of $4 per foot, including timbering. All work is by hand, and the tunnel is 5 by 7 feet clear. The timbers are obtained on the property. There are 12 men employed. ——Lew Aubury of Mariposa, superintendent.

Mary Harrison.—This mine is on the southern portion of the Cook Estate, 2 miles south of Coulterville. It is situated on the great Dolomitic vein, the quartz occurring on the foot-wall side, being 4 to 6 feet wide. Both hanging and foot walls are diabase. Black clay slates (Mariposa beds) and serpentine also occur in the immediate vicinity of the vein. The deepest workings are down 900 feet, and still sinking in July last. The ore-shoot is stoped from the 700-foot level to the surface. The lower levels are extensive. A 40-stamp mill built on the Potosi Mine, one of the group owned by this company, crushes ore from the Mary Harrison Mine, with which it is connected by 4 miles of narrow-gauge railroad. No rock was being crushed at the time of my visit. Hoisting is done by steam. There are 75 men employed. In addition to the Mary Harrison, the company also owns the Louisa, Margaret, Potosi, Malvina, and numerous other claims on this large estate, but the above described is the only one in operation.——Merced Gold Mining Company of Boston, owners. J. Mills of Coulterville, manager.

Bonanza Mine.—It is 5½ miles south of Coulterville, near the Merced River, on the Dolomitic vein. A cross-cut tunnel was in 280 feet in July last, running to intersect the vein, which was said to be 50 feet in width. The hanging-wall is slate and the foot-wall serpentine. A 20-stamp mill was in process of building, and a dam was being constructed in the Merced River for power. There are 25 men employed. ——T. P. Brisland of Coulterville, manager.

Murphy Mine.—It is 3½ miles south of Coulterville, on the main lode, having serpentine on the hanging-wall and slate on the foot, differing in this respect from the Mary Harrison, which it somewhat resembles otherwise. A shaft had reached a depth of 145 feet the middle of July, and two levels had been started. The property is equipped with steam hoist, but has as yet no mill. There are 18 men employed.——The Guffy-Galey Gold Mining Company of Pittsburg, Pa., owners. W. W. Elmer, superintendent.

Black Hill (*Pumpkin*) *Mine.*—It is 1 mile north of Coulterville, and is in the prospective stage, a shaft having been sunk 60 feet, equipped with horse-whim. Some rich ore has been found in recent development. There are 5 men employed.——John Boyd, owner. J. J. Dolan of Coulterville, superintendent.

Yosemite Hydraulic Mine.—It is 10 miles east of Groveland. The company has built 11 miles of ditch flume and pipe-line the past year, and made preparations to carry on hydraulic mining on an extensive scale; the scarcity of water, however, has affected operations seriously. When working full force 20 men are employed.——W. J. Pender of Groveland, superintendent.

MADERA COUNTY.

As it was necessary to pass through Madera County in going into Mariposa, a brief examination of two mines was made while in that county. In the neighborhood of Grub Gulch prospecting is actively being prosecuted, and also in the direction of Coarse Gold, but lack of time precluded visiting that section the past season.

The Rex Mine.—This is a new property at Grub Gulch. It has been opened within the past few months. An inclined shaft has been sunk

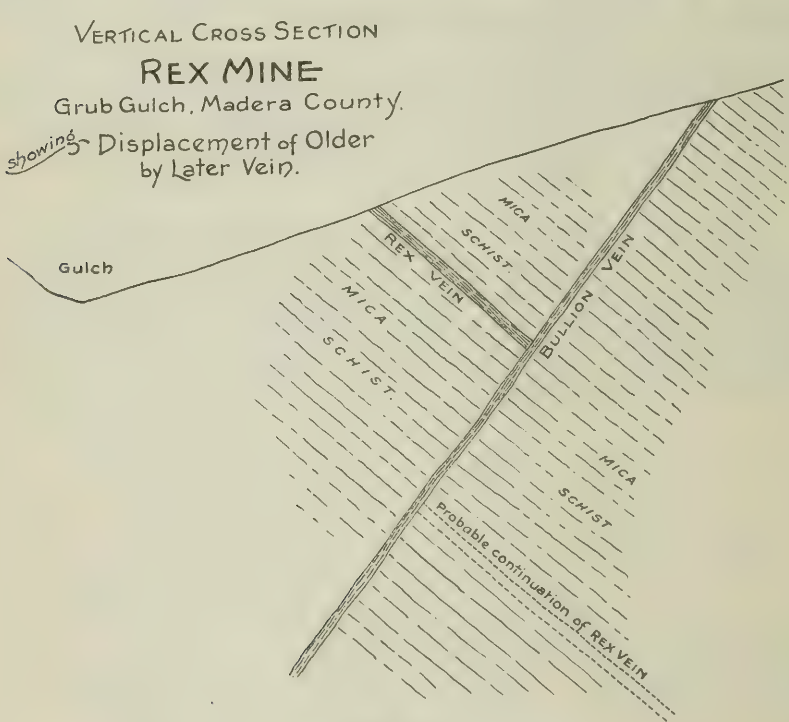


Fig. 36.

to a depth of 100 feet at an angle of 40 degrees to the eastward. At a depth of 50 feet from the surface in this shaft, the Rex vein, which is from a few inches to 14 inches in width and rich in free gold, was found intersected by another vein, known as the Bullion, which dips to the westward at an angle of 60 degrees, cutting the dip of the formation nearly at right angles and displacing the Rex vein. The formation in

which these veins occur is mica schist. That portion of the Rex vein in the neighborhood of the shaft has been opened by a series of shallow pits, and by means of these the direction of its strike can be traced along the surface. After passing the Bullion vein, which in strike intersects the Rex vein at a low angle, the Rex vein does not appear in line with the croppings on the farther side of the Bullion vein. However, farther to the northward is a vein which has the physical characteristics of the Rex vein, and also carrying the same character of gold, and this vein has been traced for more than 1000 feet from its intersection with the Bullion vein, on the opposite side of which it can be no further recognized. There is little doubt that these two disconnected veins are identical, having been dislocated by the later Bullion vein. The accompanying sketches (Figs. 36 and 37) illustrate this occurrence. As

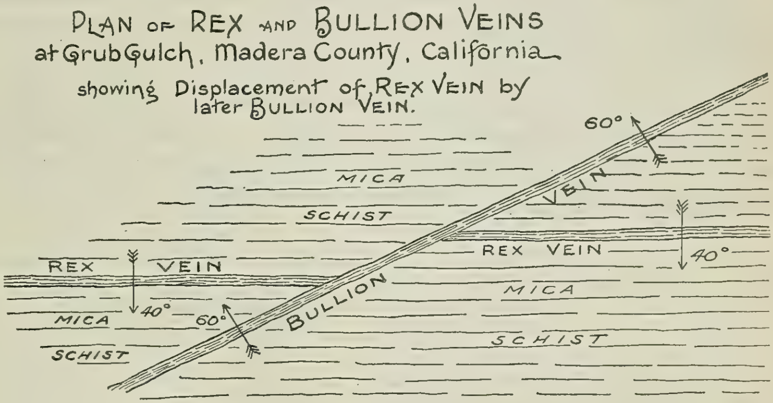


Fig. 37.

nearly as could be determined, the Bullion vein has displaced the Rex vein about 70 feet, its downward extension lying in the foot-wall and about that distance from the upper portion of the vein.——Charles M. Ward and others of Grub Gulch, owners.

Ne Plus Ultra Copper Mine.—This property is 9 miles in a southwesterly direction from Raymond, on the San Joaquin plains at Daulton. It is an old property which has been reopened since the publication of the last report. Three shafts have been sunk on the mine, 125, 140, and 145 feet respectively. These are distributed along the vein for a distance of 1000 feet. The formation is chiastolite schist. The zone of mineralization is 100 feet or more in width, in which there are several shoots of ore having an approximate parallelism with many ramifying branches. There are also dikes cutting the formation. The ore normally is an iron-copper sulphide, but in the zone of semi-oxidation, between the thoroughly oxidized gossan ores and the normal sulphide ores, oxidation is taking place very rapidly. This oxidation results in giving

out a large amount of heat, which occasions the mine workings to be unusually hot. The ore taken from certain shoots in this mine, when delivered on the dump, frequently takes fire within a few days by spontaneous combustion, and on several occasions has set on fire the cars in which the ore is transported to the smelter at Madera. A large dump situated at the south shaft has been burning for some time, and the ore now presents the appearance of an ore-pile which has been heap-roasted in the usual manner. In this mine was observed one of the very few underhanded stopes in the State. The method of working this mine illustrates to a marked degree the unfortunate policy commented upon in one of the first paragraphs of this bulletin, that of demanding immediate returns from development of ore. There are 40 miners employed in the mine, 15 on top, and 60 at the smelter, which is located near the town of Madera. The smelter was not visited.——California Copper Company of 31 Nassau Street, New York, owner. Wm. Davidson of Daulton, superintendent.

Several *copper mines* are being worked on Green Mountain about 10 miles northwest from Raymond, and there is one near White Rock, about 15 miles southwest of Mariposa. These mines are shipping high-grade, partly oxidized ores. They were not visited.

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FIG. I
N.
GEOLOGICAL RELIEF MAP
OF THE
— 1898 — PUENTE HILLS. — 1899 —
CALIFORNIA.
CALIFORNIA STATE MINING BUREAU.
A.S. COOPER, State Mineralogist.
Accompanying Report of W.L.WATTS, Assistant in Field.
Under the direction of HENRY T. GAGE
Governor of the State of California.
SCALE.
0 ½ 1 2 miles
LEGEND
shale Formation.
Abandoned Wells.
Dip of Strata.
Oil Springs & Brea.
Railroads.
Oil Wells.
County Boundaries.
Oil Sand.
POMONA
CHINO
WHITTIER
EAST WHITTIER
PLACENTIA
ORANGE
EL MODENA
PUENTE 325'
LEMON
SPADRA
SANTA FE SPRINGS
R.11 W.
R.10 W.
R.9 W.
R.8 W.
T.1 S.
T.2 S.
T.3 S.
T.4 S.
SAN GABRIEL VALLEY
SAN GABRIEL RIVER
SAN JOSE CREEK
SAN JOSE HILLS
PUENTE HILLS
Conglomerate
Sandstone
Shale
Principally Sandstone
Alluvial
Unexplored
Eruptive Rock
Metamorphic Sandstone
GRANITE
LOS ANGELES CO.
ORANGE CO.
SAN BERNARDINO CO.
Canada del Rodeo
Brea Canon
Carbonne Canon
Chino Cr.
Coyote Cr.
SANTA ANA RIVER
SANTA ANA MTS.
Santiago Canon
Puente Oil Co.
Chino Well No. 2
Chino Well No. 1
Santa Fe Oil Co.
Rex Oil Co.
Union Oil Co.
Pomona Hill 1676'
1182'
Soquel
Olinda
Wanda
Richfields
Yorba
Marlboro
Riverside
Gypsum
Grass C.
Saddle Back
Aliso Canon
Sandstone

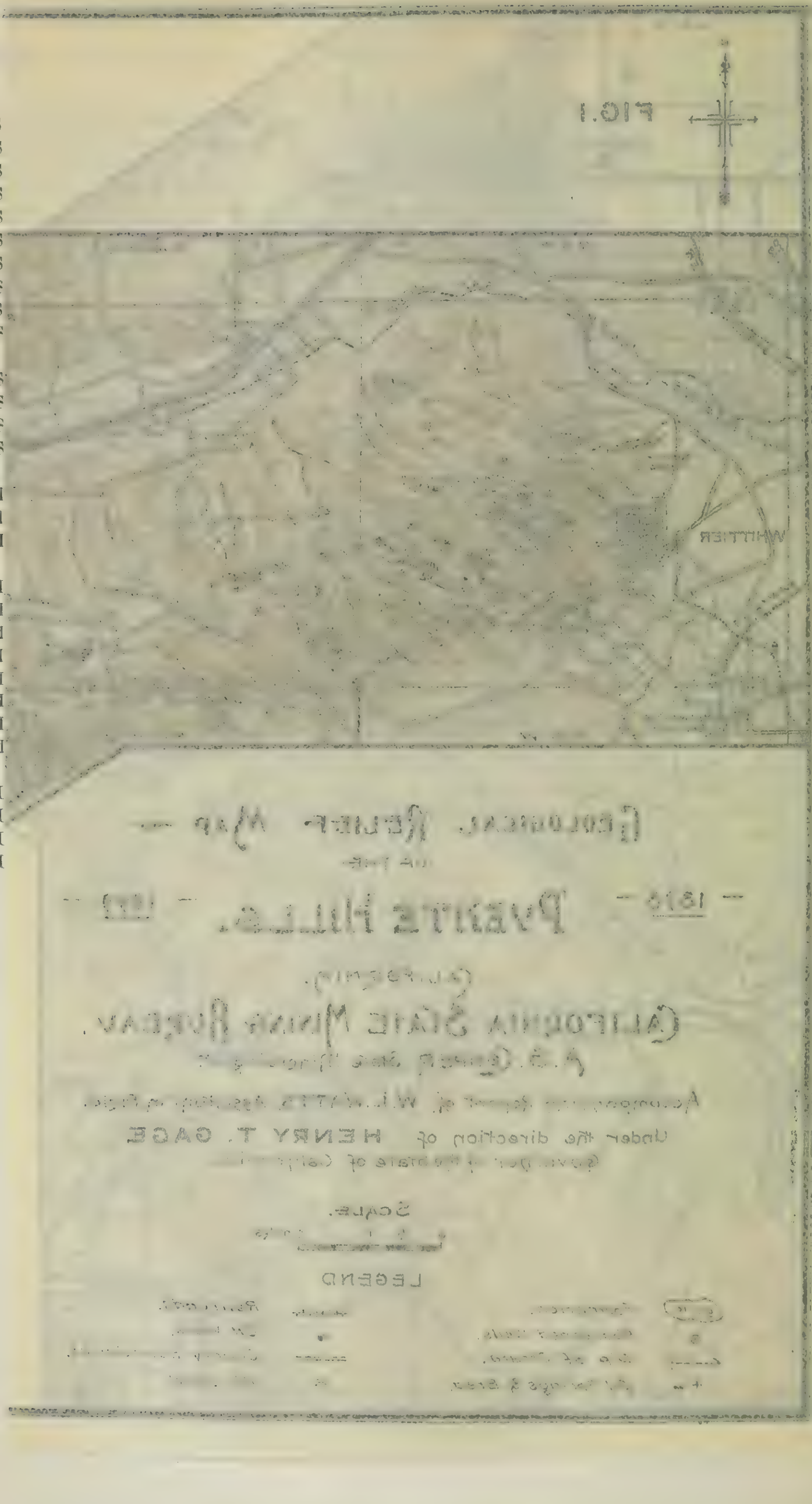
FIG. 1
WHITTIER
Geological Relief Map
of the
Puente Hills
California State Mining Bureau.
Under the direction of HENRY T. GAGE
Scale.
LEGEND

CALIFORNIA STATE MINING BUREAU.

A. S. COOPER, State Mineralogist.

BULLETIN No. 19. San Francisco, November, 1900.

OIL AND GAS YIELDING FORMATIONS

OF CALIFORNIA.

By W. L. WATTS, E.M.

Published under the Direction of HENRY T. GAGE, Governor of the State of California.

SACRAMENTO:
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1900.

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LETTER OF TRANSMITTAL.

CALIFORNIA STATE MINING BUREAU,
October 31, 1900.

To His Excellency HENRY T. GAGE, *Governor of the State of California;* THE HONORABLE THE BOARD OF TRUSTEES OF THE STATE MINING BUREAU; *and* HON. A. S. COOPER, *State Mineralogist:*

GENTLEMEN: I have the honor to submit to you Bulletin No. 19, entitled "THE OIL AND GAS YIELDING FORMATIONS OF CALIFORNIA."

The matters treated in this Bulletin are descriptions: (1) of certain territory extending westward from the Santa Ana Mountains in Orange County, to the City of Los Angeles, including the Puente Hills and the oil-fields situated therein; (2) of the Los Angeles oil-fields; (3) of certain territory extending westward along the coast-line between San Diego County and Newport in Orange County, and northward, inland, for a distance of about ten miles; (4) of the peninsula of San Pedro; and (5) of certain territory in Ventura County extending eastward from the Sespe Creek to the Piru Creek in the mountains north of the valley of the Santa Clara River.

A brief description is given of recent developments at Summerland in Santa Barbara County, and of the oil-fields in the foothills of the Central Valley of California, which have attracted so much attention. A chapter by Mr. F. M. Anderson on the oil-fields of Humboldt County, and remarks by H. S. Fairbanks, Ph.D., on the oil-yielding formations of San Luis Obispo and Monterey counties, are also included.

The geological facts which I mention, concerning the Kern River, the Sunset, and the Coalinga districts, are largely quotations from Bulletin No. 3, now out of print, for which there is a great demand. In addition to the above, I have written chapters on the structural conditions pertaining to the occurrence of petroleum, and the geographical and geological distribution of this mineral in California. I have also added a summary of available data concerning the character and fuel value of California petroleum, also a chapter on the descriptive geology pertaining to the occurrence of petroleum in the territory I have investigated. Under the head of productive wells, I have mentioned only such wells as were productive when the locality in which they are situated was visited.

The records given of fractional distillation of California petroleum are from experiments made by the late Dr. W. D. Johnston, formerly chemist to the California State Mining Bureau, and by myself.

The palæontological determinations shown in the tables at the end of this volume were made by Dr. J. C. Merriam of the State University of California; and the palæontological matter quoted from Bulletin No. 3 is based on determinations made by Dr. J. G. Cooper of Haywards.

Since the beginning of 1897, I have been stationed principally in Southern California. A large portion of my time has been devoted to answering questions and attending to correspondence concerning not only petroleum, but also other minerals. This class of work has been especially onerous during the petroleum excitement of the past two years. I have also collected and compiled the annual statistics of petroleum and of several other mineral products in the southern part of the State.

Since my appointment, in 1899, as State Expert in California Mining, I have had charge of all the field-work of the State Mining Bureau prescribed under Chapter XCV, Statutes of California, 1899. Furthermore, in order that there might be no delay in placing before the public the information obtained, I delivered lectures and compiled maps, giving such facts concerning the oil-yielding districts as my investigations warranted. By these means, many of the facts set forth in this Bulletin found their way into the public press. Although the greater portion of this report might have been printed somewhat earlier, I considered it advisable to complete the work already in hand, and bring the statistical portion as nearly as possible up to date before offering my report for publication.

Allow me to take this opportunity of returning thanks to the numerous gentlemen who have aided me in my work; also to the Academy of Sciences of San Francisco, California, and the Los Angeles Chamber of Commerce, for courteous assistance in the matter of office room. Permit me also to thank the Puente Oil Company, the Union Oil Company, and D. C. Cook, Esq., of Piru, Ventura County, for the handsome gift of text-books which they presented to the Library of the California State Mining Bureau as a token of their appreciation of the researches made by our Department concerning the oil-yielding formations of California.

Most respectfully,

W. L. WATTS.

OIL AND GAS YIELDING FORMATIONS OF CALIFORNIA.

PART 1. CHAPTER 1.

INTRODUCTORY.

1.1.1.* California's mineral wealth consists not only in those minerals from which metals are obtained, but also in numerous other mineral substances, which become in greater demand as our manufacturing interests expand and as our civilization advances.

The most important of the latter class of minerals, which, in a commercial sense, may be regarded as non-metallic, are the hydrocarbons; and of these, petroleum, in the form of asphaltum, oil, and natural gas, is of the greatest value. This Bulletin is confined to the last two of these items.

It is only of late years that the importance of the petroleum interests of California has been recognized. The value of our petroleum industry is far-reaching. Exclusive of asphaltum and gas, it is represented by the amount of foreign capital expended in the work of extracting and handling the oil, by the price obtained for that portion of our petroleum which is exported by California residents, and by the value of that portion which is consumed in California. The part consumed in this State constitutes the bulk of our petroleum output, and is used chiefly as fuel, thus becoming one of the leading factors in our commercial economy.

In California the question of petroleum as fuel assumes a special importance, owing to the fact that the deposits of coal thus far discovered in our State are inadequate to the steadily increasing demand for fuel.

1.1.2. Since the publication of our last Bulletin on this subject, the opening of new oil-fields has widened the horizon of research; and it is very encouraging to note that the new developments have been made along lines indicated in the reports of the Mining Bureau.

1.1.3. Investigations in which information is gathered by interviewing parties interested, and obtaining from them data which are the result of their researches, or by the compilation of records, can be made

*The numbers at the beginning of the paragraphs are so arranged that the figure on the left hand denotes the Part, the next the Chapter, and the figure or figures on the right hand the Paragraph. Thus, 1.2.15 means Part 1, Chapter 2, Paragraph 15.

with rapidity; but investigations which require that information be gathered by the personal research of the investigator demand a much longer time. In many instances the latter class of investigations involves a concentration of energy within a comparatively small area. Thus, in Los Angeles, Orange, and Ventura counties it was apparent that the relation of the oil-yielding rocks to the rocks which inclose them should be demonstrated; but this was not the work of a day or a week or a month.

1.1.4. There are few things which facilitate education as much as the object method of imparting ideas; hence, the stress laid on maps and illustrations.

1.1.5. There has been some discussion as to the value of fossils in connection with researches among the petroleum-yielding rocks of California.

In order to make a competent record as to the occurrence of petroleum in this State, it is necessary to define the rocks in which petroleum is found, and to show their horizontal and vertical range; or, in other words, to show the area over which they extend, and the way in which they lie one on another. Furthermore, such a record requires that the petroleum-yielding rocks in the different oil-fields should be correlated with the geological formations of the State at large. The physical character of sedimentary rocks is an insufficient index by which to classify them. The rock-forming sediments in every age consist of mud, calcareous matter, sand, and fragments of rock, which have formed respectively shale, limestone, sandstone, and conglomerate.

The accepted method of distinguishing such rocks or groups of rocks belonging to one age, from similar rocks or groups of rocks belonging to another age, is by means of the fossils they contain, which show the form of life existing at the time the sediment forming the rocks was deposited.

This report describes a series of sandstones, shales, and conglomerates in which petroleum is found. It is essential, therefore, to mention such evidence as may define the position of these sandstones, shales, and conglomerates in point of vertical as well as of horizontal range, and to show their relation to the other sedimentary rocks found throughout California. Much more might be said as to the value of fossils in geological investigations.

1.1.6. In order to systematize the work, it has been found necessary to confine investigations to definite lines of research. The direction of these lines has been determined by the probabilities of finding the requisite geological data, by the amount of development done or about to be done in different areas, by the amount of interest taken in the work of investigation by citizens connected with the petroleum industry in the various oil-yielding districts, and by the demands for information concerning districts which were supposed to have value as oil-lands.

PART 2.

TERRITORY BETWEEN THE SANTA ANA MOUNTAINS IN ORANGE COUNTY AND THE SAN GABRIEL RIVER IN LOS ANGELES COUNTY.

CHAPTER 1.

GEOLOGY OF THE PUENTE HILLS.

2.1.1. In Los Angeles County there are three distinct formations which comprise the oil-yielding rocks and the rocks which inclose them, and it became apparent that the relation of these formations one to another should be demonstrated. Since the most urgent requests for information came from parties operating or about to operate oil-territory in the Puente Hills, in Los Angeles and Orange counties, those hills were selected as an area within which to work out the problem.

2.1.2. Reference to Figs. 1 and A shows that the Puente Hills consist of a low range cut off from the Santa Ana Mountains by the Santa Ana River. On the north they are separated from the San José Hills by the south fork of the San Gabriel Valley (see Photo No. 9); on the west they are separated from the Rapetto Hills by the San Gabriel River; on the south they slope down to the valley of the Santa Ana River and the level country which stretches southward toward the Pacific Ocean, about 20 miles away. The highest elevation in the Puente Hills is about 1650′. The elevation of the valley of the Santa Ana River ranges from about 200′ near the village of Olive to 450′ at the narrows, where the Santa Ana River divides the Puente Hills from the Santa Ana Mountains. The elevation of the south arm of the San Gabriel Valley varies from about 350′ near the west extremity of the Puente Hills, to about 700′ near the village of Spadra.

2.1.3. The Puente Hills are traversed by numerous cañons. Their trend appears somewhat erratic, but Fig. 1 shows that in a general way the cañons are of two orders: (1) Numerous small cañons, which run nearly at right angles to the crest of the hills; (2) Larger cañons, which either cut through the crest of the hills or run parallel to their course. The cañons of the first order have been formed principally by erosion. The course of the cañons of the second order has probably been determined by the geological structure. The trend of the cañons which cut through the crest of the hills is east of north, as is seen by

looking at the Sycamore and Turnbull cañons, the Cañada del Rodeo, and the upper portions of the Soquel and Brea cañons. The trend of the cañons which run nearly parallel to the crest of the hills is east of south, and can be observed best by noting a depression which, as depicted in Fig. 1, extends through the Puente Hills and forms portions of cañons at the Central, the Puente, and the Santa Fé oil-wells, and in the lower portions of Brea, Soquel, and Telegraph cañons. The course of the cañons of the second series appears to follow the course of folds or faults in the rocky strata. Thus, Rodeo Cañon and portions of Brea, Soquel, and Telegraph cañons are evidently worn along the axes of folds; for on one side of these cañons the strata dip in one direction, and on the other side in the opposite direction.

2.1.4. All the rocks seen by the writer in the Puente Hills are of sedimentary origin, except in the low foothills immediately south of Pomona, where granite and eruptive rocks are exposed. The sedimentary rocks show little or no signs of alteration, except in the spur of hills which culminates in Pomona Hill, and at the Sulphur mines which are about 1 mile northwest of Whittier, where the rocks have been subjected to chemical change by the action of sulphureted vapor.

2.1.5. At Pomona Hill there are sedimentary rocks consisting of hard brownish sandstones and a few strata of crystalline limestone. At the Sulphur mines the sedimentary rocks are decomposed by chemical action.

2.1.6. The unaltered sedimentary rocks of the Puente Hills may be classed in three groups. Mentioned in the order of their upward vertical range they are as follows:

2.1.7. *First*—A group consisting of sandstone varying in color from white to light brown or yellow. The sandstone is interbedded with some shale and a little conglomerate. The uppermost beds of this series consist of a very silicious shale. These sandstones correspond to certain sandstones in the Santiago Cañon, which contain fossils, the age of which probably corresponds to that of the Lower Neocene formations in the Central Valley of California. (See table of fossils.) As seen in Fig. A, a large portion of the Puente Hills lying to the north and east of the Puente oil-wells is formed of these sandstones. At several points these sandstones are, or have been, impregnated with bituminous matter and constitute "dry oil-sands." Only in two instances did the writer note a spring of liquid petroleum in this formation.

2.1.8. *Second*—A group consisting of shale with a few strata of sandstone, which become thicker and more numerous toward the bottom of the formation. The upper portion of the rocks of this group consists of thin-bedded clay-shales and sandy strata; lower, the shales become a putty-like clay; still lower, they are sandy and are interstratified with sandstone. In some places the lower portion of this shale is white or

whitish. It appears either to have undergone some chemical change or to be made up largely of diatomaceous material, for in some places it resembles diatomaceous earth. The sandy strata interstratifying the lower portion of the shale formation constitute the principal oil-sands which have been penetrated by the productive oil-wells in the Puente Hills. These oil-sands, where they crop out at the surface of the ground, may or may not show traces of oil; in many places they show a brown pulverulent sandstone, but when the surface is removed the sandstone smells more or less of petroleum. At one point on the south side of Brea Cañon the shale contains nodules of limestone with fossils of Middle Neocene age. (See table of fossils No. III.)

2.1.9. *Third*—A group consisting of conglomerate, sandstone, and a little shale. In this group the conglomerate preponderates. The pebbles forming the conglomerate are, for the most part, granitic with black mica. In some places the conglomerate contains shells of Middle Neocene age. (See table of fossils No. III.) It appears, therefore, that these shales and conglomerate correspond in point of age to what are hereinafter described as the Middle Neocene formations of the Central Valley of California.

At some points the rocks forming the conglomerate are more or less impregnated with petroleum; indeed, two of the wells of the Santa Fé Railroad Company yield oil from strata of conglomerate.

2.1.10. The complexity of the geological structure, the alluvium which covers the greater portion of the Puente Hills, and the scarcity of fossils made the differentiation of these formations slow work. Indeed, it was not until the country on the east side of the Santa Ana River was reached that the relative position of the conglomerate, shale, and sandstone was clearly made out.

2.1.11. An examination of Figs. 1 and A shows that the conglomerate forms a fringe around the base of the hills. At a higher elevation the conglomerate has been worn away, disclosing a formation of shale underlying it. At still higher elevations, the conglomerate and shale have both been worn away, disclosing the sandstone which forms the greater portion of the eastern half of the Puente Hills.

2.1.12. Crossing the Santa Ana River to the western end of the Santa Ana Mountains, we find the same sequence of formation. Thus, traveling east from the village of Olive, and ascending a ridge belonging to the foothills of the Santa Ana Mountains, we pass over, first the conglomerate, then the shales, then the sandstone. The sandstone rests on older rocks.

2.1.13. If we examine Fig. A, we see that at two points there are small patches of conglomerate surrounded by shale. The patches of conglomerate are "outliers" (i. e., patches remaining of the sheet of conglomerate which at one time covered the shale, but which has been

partly removed by erosion). The question of the conformability or non-conformability of these formations will be discussed later.

2.1.14. In Fig. A only the leading structural features are shown, for in many places the strata are much disturbed and the stratigraphy is so complicated that it cannot be represented to advantage or any definite structure figured therefrom.

2.1.15. In the Puente Hills there are two predominant systems of folds or lines of geological disturbance. They are disjointed and rather hard to trace, and at many points they resemble faults rather than folds; but since for the most part they show an anticlinal structure and play an important part in the distribution of the oil-lines in the Puente Hills, they are herein spoken of as folds and cross-folds. The most important of these folds have a strike of east of north, and in the southern portion of the Puente Hills they mark the axis of a larger anticlinal fold of which they form a part. The cross-folds have a strike of east of north. The general effect of these folds and cross-folds has been to break up the formation into blocks, which fact adds greatly to the complexity of the geological structure.

The course of the first-mentioned series of folds is marked on Fig. A by lines AA, BB, XX, ZZ, DD. As stated, the second series are cross-folds to the folds of the first series. They can best be seen by examining the strata exposed in cañons, which, as hereinbefore mentioned, cut through the crest of the hills. The rock-exposures which indicate the cross-folds are seen to the best advantage on the slopes of the hills.

The complexity of the stratigraphy and the scarcity of rock-exposures in the Puente Hills render it hazardous to define the course of the axes of folds as precisely as is done by lines XX, ZZ, AA, BB, in Fig. A. These lines must be considered merely as pointers to direct the reader to the stations at which the exposed rocks give a clue to the course of the folds.

It may appear that, in some instances, the inclined strata, treated as indicating cross-folds, may really be the termination of short anticlines. Reference to Fig. A shows that at the points where the existence of cross-folds is inferred, the dip does not swing around the axes of the dominant folds, but frequently inclines toward it, and in some cases both limbs of the cross-folds can be observed. At a few places the exposed rocks suggest a local reversal, and at one point, as is shown in Photo No. 1, the reversal is evident. There is, however, no ground for believing that there is extensive overturning of the formations in the Puente Hills.

2.1.16. The southern portion of the Puente Hills constitutes an anticlinal ridge, which has a trend of S. 70° E., or thereabouts. Through that portion of the Puente Hills which lies between the Central oil-wells and Brea Cañon, two lines of geological disturbance can be traced, which

PHOTO 1. Overturned Fold in Puente Hills, Los Angeles County.

PHOTO 2. Crushed Sandstone in Puente Hills, Los Angeles County.

have a strike of west of north. The axes of these folds have an average trend of about S. 70° E., and they are marked on Fig. A by lines AA and BB, respectively. In the syncline between these subordinate folds there appears to be a fault-line, the downthrow being to the south.

2.1.17. The northernmost of these folds or lines of disturbance (see line AA, Fig. A) can be traced as follows: From Station 228, in the edge of the foothills, west of Turnbull Cañon, where the formation is sandy shale, to the abandoned oil-wells in Turnbull Cañon, and thence to Station 150 in Woersham Cañon, where the formation consists of oil-sand and thin-bedded sandstone, with conglomerate on the southern limb of the fold. From Station 150 it probably extends to Station 134 at the Central oil-wells, where the formation is oil-sand and crushed shale. Between Stations 33 and 34 the prevailing dip is to the north; the formation is clayey and sandy shale, apparently resting on conglomerate. Since the normal position of the conglomerate is on the top of the shales, the structure at this point indicates a fault or a reversal.

2.1.18. It is probable that this fold extends to Station 58, where the oil-sand is exposed near the axis of the fold. At Station 58 the southern limb is very short and crushed, and the oil-sand is overlain by sandy and clayey shale; on the northern limb the oil-sand is overlain by sandy and clayey strata and conglomerate. Fold AA probably extends to Station 70, where the formation is sandy shale; and on the northern limb of the fold the sandy shale is overlain by conglomerate. Near this point the shale on the southern limb of the fold is white, and appears to be diatomaceous. Farther to the southeast the structure is very irregular, and appears to be complicated by cross-folds which have a strike of about N. 40° E. The best evidence as to the course of these cross-folds is to be found at Stations 39, 35, and 36, on the north slope of the Puente Hills.

2.1.19. Farther eastward and immediately west of the Puente oil-wells, the shales have been worn away, exposing the underlying sandstone, which appears to be chiefly influenced by the folds having a northeastern strike.

2.1.20. At the Puente oil-wells the axis of a fold is exposed, on both sides of which are numerous remunerative wells belonging to the Puente Oil Company. (See wells of Puente Oil Company.) The rocks exposed in the Puente Cañon are principally shales, varying in color from dark brown to light brown or whitish, and in composition from sandy to clayey or calcareous. The strike of the exposed strata varies from S. 80° E. to N. 80° E. At the Puente oil-wells a cañon has been worn along the axis of a fold, showing a strike of south of east. There appears also to be a cross-fold having a strike of north of east. This is corroborated by the drilling record of the Puente Oil Company, which indicates that the strike of the oil-sand at the Puente oil-wells is a little north of east.

2.1.21. For nearly 2 miles east of Puente oil-wells the formation is much disturbed. The prevailing dip is northerly. The rocks are shales and sandstones. It is not until Brea Cañon is reached that the structure of the formation can be definitely figured out. The structure of the formation from Brea Cañon eastward will be discussed later.

2.1.22. The most southerly of the folds or lines of disturbance previously mentioned as having a southeast course and extending eastward from the Central oil-wells, is marked BB on Fig. A. It is situated at a lower elevation and is less easy to trace than is line AA; for along its course it is only here and there that the rocks are not covered with alluvium. In the conglomerate, which forms the lower portion of the Puente Hills immediately to the north of the town of Whittier, and west of the Central Oil Company's wells, there is no trace of this fold; but a somewhat extensive oil-spring near Station 11 in Savage Cañon lines up with the strike of the axis of the fold. The western extremity of this fold is noticeable at the Central oil-wells, the northern limb of the fold being soft sandstone, and the southern limb soft sandstone covered with conglomerate. The most remunerative wells of the Central Oil Company are on the south limb of this fold. (See Photo No. 3.) About 1 mile farther to the east, near the abandoned well of the Mutual Oil Company, the axis of this fold is again exposed. Its northern limb shows sandy shale and soft sandstone, and its southern limb soft sandstone covered with conglomerate. About a quarter of a mile south of the Mutual Oil Company's well, are the Chandler wells.

A short distance south of Station 34 the axis of fold BB is again seen, and there is an oil-spring. At this point the northern limb of the fold consists of comparatively soft sandstone and sandy shale overlain by conglomerate. For a short distance down the southern limb of the fold, the formation is conglomerate; but at Station 37 the clay-shale comes to the surface. The outcrop of clay-shale at this point is probably due to a fault, the trend of which is southeasterly. At Station 37 the clay-shale contains Middle Neocene fossils. (See table of fossils No. III.)

The next point where the axis of this fold can be observed is Station 55, the exposed rocks being, for the most part, grayish sandstone and sandy shale. Continuing in a southeasterly direction, which observation has shown to be the trend of the axis of the fold under consideration, more than half a mile of alluvium-covered territory is passed over, until, at Station 270, conglomerate and sandstone are seen dipping east of north. The hills between Station 270 and the La Habra Valley are composed of conglomerate and sandstone, dipping to the south. Still pursuing a southeasterly course to Station 230, soft sandstones are seen dipping to the north. Near Station 230 a well has been drilled by the Union Oil Company which has shown more or less oil from the surface down; and

PHOTO 3. Central Oil-Wells, Los Angeles County.

PHOTO 4. Oil-Wells in Brea Cañon, Orange County.

two pits have been sunk in oil-yielding rock. (See Union Oil Company's well at La Habra.) Farther to the southeast, the same course passes through Station 218, where the axis of an anticline can be observed.

2.1.23. The rocks dipping to the north are principally calcareous shale and soft sandstone; those dipping to the south are principally conglomerate and sandstone.

East of Station 218, there are some points where the exposed rocks show an anticlinal structure, which may possibly indicate an extension of the line of disturbance marked by line BB. Thus, a short distance south of the wells of the Puente Oil Company the structure is anticlinal, the formation being crushed shale impregnated with petroleum, and there is a small deposit of brea*. Farther to the east the formation is conglomerate and sandstone. In this portion of the Puente Hills the rocky formations are cut through by Brea Cañon, along the southern side of which the axis of a fold can be traced.

2.1.24. It will be observed that the axes of the folds AA and BB can not be followed in a straight line for any great distance. This may be accounted for by the block-tilting previously mentioned or by faults running in the direction of the dip; or it may result from variation of surface elevation, coupled with the fact that the axis of a fold may have different inclinations at different points.

2.1.25. From the foregoing it appears that the western portion of the Puente Hills consists of an anticlinal ridge, traversed by two systems of folds. The folds belonging to one of these systems are dominant folds. To this order of folds belongs the one indicated by line XX. It is interesting to note that if the axis of this fold were extended westward, it would enter the valley lands at or near the sulphur deposits about 1 mile northwest of the town of Whittier. The folds belonging to the other system have a course of east of north, and are cross-folds to the folds running west of north; it is doubtless a fold of this order which has given the strata exposed in Sycamore Cañon a strike of east of north. In Sycamore Cañon the dip is west of north; we look in vain, however, for the axis of a fold having a strike east of north, unless one is inferred from the fact that in Sycamore Cañon the exposed strata dip west of north, and that the conglomerate south of Turnbull Cañon dips east of south.

2.1.26. It is a reasonable deduction that, in a general way, the strike of the oil-lines follows the strike of the axes of the folds, or of the blocks of strata on which they are situated. It is evident that in rocky formations possessing as complex a structure as those of the Puente Hills the folds have been modified by fracture and faulting; but where the rocks are much covered by alluvium it is impossible to work out details of such displacement from surface observation.

* Asphaltum formed by the exudation of heavy oil.

2.1.27. The reader will be able to gather a further conception as to the geological structure of that portion of the Puente Hills which has been thus far described, by examining the cross-sections shown in Figs. 2, 3, 4, 5, paying attention to the arrows indicating the change in the dip of the different strata, and by noting also the position of the cross-sections in Fig. A.

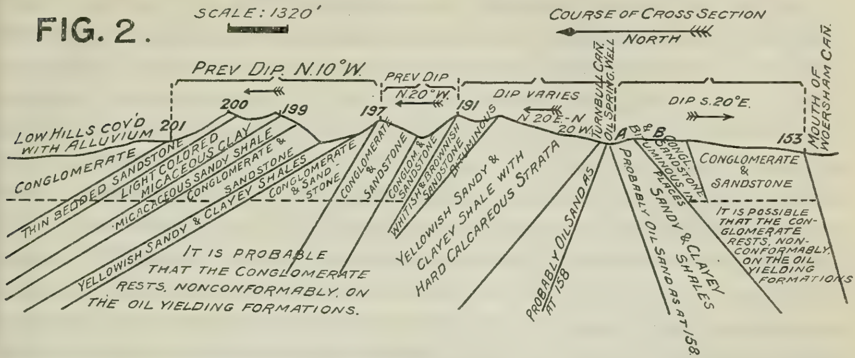
2.1.28. Fig. 2 represents a cross-section about 3 miles in length through the western end of the Puente Hills. It shows the general structure to be that of an anticlinal fold. If we infer the strike of the axis of this fold from the prevailing dip of the strata on the outermost slopes of the fold, we should conclude that it is N. 80° E., or thereabouts. As the axis of this fold is approached, there is a discrepancy between the strike of the clayey and sandy shales which have been found elsewhere resting on the oil-sand (as is shown in Fig. 2) and the conglomerate which overlies them. An analysis of Fig. 2 shows that the first outcropping rock observed on the northern side of the Puente Hills at this point is conglomerate, consisting of fine pebbles. (See Station 201, Fig. A.) The stations mentioned in paragraphs 28, 29, 30, 31 refer to those shown in the diagram of cross-sections, unless it is otherwise stated. Pursuing a southerly course, the following formations appear to rest with practical conformability one upon another: Thin-bedded sandstone, light-colored micaceous clays, micaceous sandy shale, conglomerate sandstone, and clay-shale; the latter being very similar in appearance to that before mentioned as overlying the oil-sand in other places.

Between Sycamore Cañon and Dark Cañon conglomerate is again the prevailing rock, the direction of the dip being practically the same as on the northern side of Sycamore Cañon, but the angle of the dip increases to 60° or more. This probably indicates a fault on the northern limb of the fold. At Station 191 the conglomerate is underlain by a brownish and whitish sandstone, some of which is pulverulent and indicates dry oil-sand. If this sandstone is followed along its line of strike to Station 216 (see Fig. A), a sandstone saturated with petroleum is found underlying the conglomerate. Beneath this sandstone is a yellowish shale, which varies from clayey to sandy and is interbedded with sandstone and hard calcareous strata. These shales constitute a very characteristic formation in the Puente Hills and appear to overlie a body of oil-sand, which, at Station 150 (see Fig. A), shows a thickness of about 50′. The dip of these shales varies from N. 20° W. to N. 20° E., and along the line indicated on Fig. 3 the angle of inclination does not exceed 50°; at many points it is less.

In Turnbull Cañon there is an oil-spring; and a few rock-exposures indicate that the formation corresponds to that exposed at Station 150. Several years ago two wells were drilled near the mouth of Turnbull

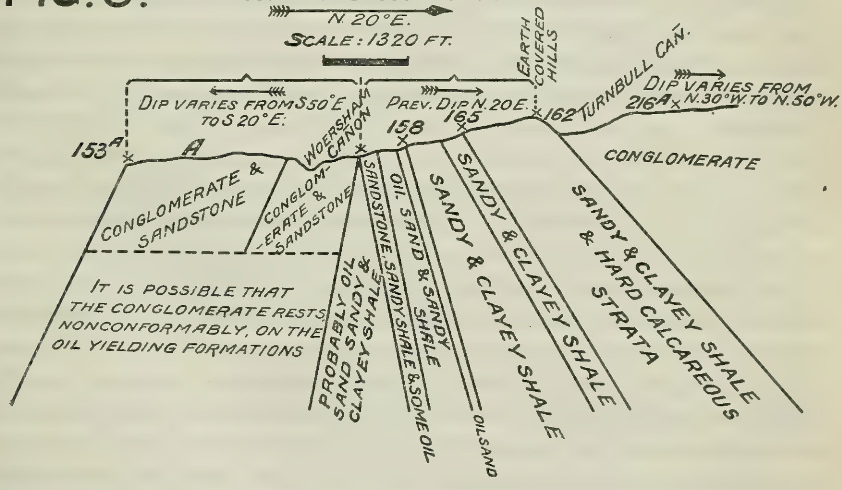
CROSS SECTION THROUGH W. END PUENTE HILLS FROM STA. 153 AT MOUTH OF WOERSHAM CAÑON TO STA. 201 N. OF SYCAMORE CAÑON

FIG. 2.



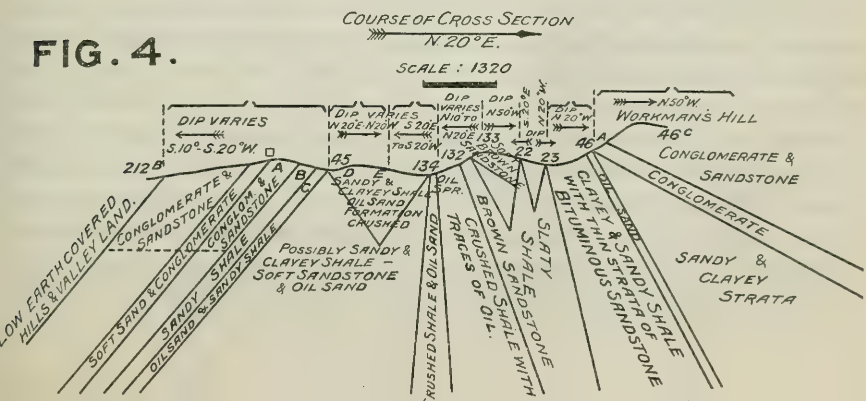
CROSS SECTION RUNNING N.20°E FROM STA. 153ᴬ NEAR THE MOUTH OF SAVAGE CANON TO STA. 216ᴬ ON N. SIDE OF TURNBULL CAÑON.

FIG. 3.



CROSS SECTION RUNNING N 20°E. FROM STA. 212ᴮ NEAR MURPHY WELL TO 46ᶜ A SHORT DISTANCE N. OF U.S. SIGNAL STA. IN SEC. 14. T2S. R.11 W.

FIG. 4.



Cañon; and it is said that one of them, a 400′ well shown in Fig. A, would have been remunerative had not an accident occurred in the drilling which choked the well. On the summit of the hill, immediately south of Turnbull Cañon, the exposed rocks consist mainly of conglomerate and sandstone. In some places this sandstone looks as though it had been impregnated with oil; but the oil has evaporated, leaving the sandstone colored with carbonaceous residuum. A short distance southeast of the abandoned well in Turnbull Cañon is the first well drilled by the Home Oil Company of Whittier.* At, and immediately around, this well, the exposed rocks are principally conglomerate; and the drilling records show that the strata to a depth of about 900′ resemble the sandy and clayey shale, which, as before mentioned, is found immediately overlying the oil-sand at Station 150. This well proved a "dry hole," and was abandoned. Subsequently the Home Oil Company drilled a well about a third of a mile southeast of their abandoned well and close to the axis of the fold; they were successful. (See Home Oil Company.) At the mouth of Savage Cañon are the wells of the Whittier Oil Company. Their records show that after drilling through conglomerate for a few hundred feet, a formation was penetrated resembling the clayey and sandy shale, which, as before mentioned, underlies the conglomerate.

2.1.29. Fig. 3 represents a cross-section running N. 20° E. from Station 153*a* near the mouth of Savage Cañon to Station 216*a* on the northern side of Turnbull Cañon, a distance of rather more than 1½ miles. Fig. 3, like Fig. 2, delineates an anticlinal fold, but the position of the oil-sand is more clearly shown than it is in Fig. 2. An analysis of this cross-section shows as follows: In the foothills near the mouth of Savage Cañon the exposed rock consists of conglomerates and sandstones, which have a dip ranging from S. 5° E. to S. 20° E. About a quarter of a mile east of point A, Fig. 3, there are oil-springs. The angle at which the conglomerate dips is about 65°. A short distance south of Station 150, Fig. A, the axis of the fold is exposed, and close by, on the south side of the fold, are the wells of the Home Oil Company. (See Home Oil Company's wells.) The rocks on the north side of the fold are thin-bedded sandstone, sandy shales, and oil-sand; and on the southern side conglomerate and sandy strata. At Station 150, strata of soft sandstone, aggregating about 50′ in thickness, are impregnated with oil, and the rocks between Station 150 and the axis of the fold show more or less indications of petroleum. The formation overlying the oil-sand is yellowish clayey and sandy shale interbedded with a few strata of sandstone and hard limestone. At this point the shale formation is at least 800′ thick, perhaps twice that thickness, but there is a

*Since the writing of this manuscript, several wells have been drilled between Turnbull Cañon and the Central oil-wells. (See wells in Whittier oil-field.)

fault at Station 165 which renders it impossible to make a more exact estimation. A few rock-exposures between Station 165 and Turnbull Cañon indicate a broken structure. The oil-sand and overlying shales show a prevailing dip of N. 20° E. On the northern side of Turnbull Cañon the formation is conglomerate, and the dip varies from N. 30° W. to N. 50° W.

2.1.30. Fig. 4 represents a cross-section running N. 20° E. from Station 212*b*, near the Murphy well, to a point north of the United States signal station in Sec. 14, T. 2 S., R. 11 W., S. B. M. Reference to the plan of the locality (see Figs. 1 and A) shows that the cross-section indicated runs through the territory in which the wells of the Central Oil Company are situated. Fig. 4 exhibits a much more complicated structure than is delineated in Figs. 2 and 3. An inspection of Fig. 2 shows that the conglomerate has been removed from a much larger area in the territory immediately under consideration than is the case to the west. It follows that the rocks underlying the conglomerate are brought to light, and they exhibit a fold which is not seen in the conglomerate farther westward. It is not impossible that this fold may be represented by fractures in the conglomerate which cannot be readily discerned by surface observation. Fold BB, Fig. A, is clearly seen at the Central oil-wells; farther westward, along what we may reasonably presume to be the strike of the axis of this fold, there is an oil-spring and an exposure of oil-sand; but the oil-sand and the adjacent conglomerate dip uniformly to the south.

An analysis of Fig. 4 shows as follows: From Station 212*b*, the rocks exposed on the highlands are conglomerate and sandstone, which at point B give place to soft sandstone and sandy shales. About 200 yards S. 80° E. (i. e., along the strike of the formation) from point A is well No. 3 of the Central Oil Company. The record of this well shows that after passing through the conglomerate, "clay and gravel," for 340′, sandy and clayey strata (probably sandy and clayey shales) were penetrated to a depth of 880′, at which depth the oil-sand was struck and a remunerative well obtained. About 400′ S. 80° E. (i. e., on the strike of the formation) from point B, is well No. 7 of the Central Oil Company. The formation penetrated resembles that observed in well No. 3, below a depth of 340′. Remunerative oil-sand was struck in this well at a depth of 620′. Near point C is well No. 5 of the Central Oil Company. The formation penetrated resembles that observed in wells Nos. 3 and 7, but the oil-sand was not struck until a depth of 635′ was reached. As this well is nearly on the axis of the fold, it is somewhat extraordinary that the oil-sand was not struck at a less depth.

In the vicinity of Station 134, the scanty rock-exposures show sandy and clayey shales, and the formation is much crushed. The latter feature is also evidenced by the character of the formation penetrated by wells Nos. 2 and 4 of the Central Oil Company.

About 500′ S. 80° E. of point D is well No. 2. The formation penetrated is sandy and clayey shale and oil-sand, which appeared to be broken and crushed. Considerable oil was found between the depths of 650′ and 1135′. About 450′ S. 80° E. from point E is well No. 4. The formation penetrated in this well resembles that observed in well No. 2. At Station 134 the axis of another fold is exposed. The formation is oil-sand and dark-colored shale; the rocks are much crushed and stand at an angle of 85°, the direction of the dip being S. 20° E. to S. 20° W., and N. 10° E. to N. 20° E. At this point there is an oil-spring. Between Stations 134 and 132 the formation is crushed shale, with traces of oil. Between Stations 132 and 133 the shale gives place to a rather thick-bedded brown sandstone, and the dip lessens to about 60°. Several springs of mineral water ooze from this sandstone.

At Station 133 a soft brown micaceous sandstone is exposed, which dips N. 50° W., at an angle of about 25°. Immediately north of Station 133 the hills are covered with alluvium; but in a ravine a slaty shale crops out, which is crumpled into two compressed folds at Stations 22 and 23 respectively. North of Station 23 the formation is sandy and clayey shale, with thin strata of bituminous limestone. This formation is overlain by an oil-sand, which crops out at Station 46*a*. Resting with apparent non-conformability on the oil-sand is a formation composed of clayey and sandy strata, which has a dip of N. 40° W.; and still farther to the north is a thick deposit of conglomerate, which has a prevailing dip of N. 40° W.

2.1.31. Fig. 5 shows a cross-section running N. 20° E. through the Puente Hills north of La Habra, namely, from Station 261*a* near the southwestern corner of Sec. 32 to Station 236 near the northeastern corner of Sec. 29, T. 2 S., R. 10 W., S. B. M. Between Stations 261*a* and 244, Fig. 5, the exposed rocks are conglomerate and sandstone, the prevailing dip being S. 10° E., at an angle of about 25°. At Station 244 the formation is sandy clay, which dips S. 20° W., at an angle of about 30°. Half a mile or more N. 80° W. from point A are the wells drilled by the Union Oil Company near La Habra; close to the Union Oil Company's wells are two pits which penetrate rocks saturated with petroleum. At Station 245, a gray sandstone, which is capped with a stratum of limestone, dips N. 20° E., at an angle of about 65°. The physical appearance of the sandstone corresponds to the sandstone near the Union Oil Company's wells. At Station 270, Fig. A, about a quarter of a mile northwest of this well, a similar sandstone is capped with conglomerate, which pitches to the north. To the north of the La Habra Creek, as shown between Stations 245 and 246, Fig. 5, the formation consists of sandy shales, soft sandstones, and oil-sand. As seen in a cañon running nearly at right angles to the strike of the formation, these rocks are much crushed, and, for the most part, stand at angles ranging from 50° to 90°.

At several places the sand is impregnated with petroleum, and at one point there is a spring of mineral water. The direction of the dip ranges from N. 20° to N. 70° W., and in a few places the strata are inclined to the south. Between Stations 246 and 342 the formation is sandy shale. Near Station 181 (see Fig. A) the axis of another fold is exposed, the formation being oil-sand and sandy shale, as shown at Station 342, Fig. 5. The dip of the oil-sand is N. 30° E., and that of the sandy shale varies from N. 30° E. to N. 50° W. The sandy shale is overlain by conglomerate, which shows a dip of from N. 30° W. to N. 70° W. at an angle of about 35°.

2.1.32. From the foregoing it appears that in the portion of the Puente Hills which extends between Whittier and the Santa Fé oil-wells, the geological structure is that of an anticlinal fold modified by certain subordinate folds in the rocky formations, which are indicated in Fig. A by lines XX, ZZ, AA, and BB. As previously noted, it is probable that, in a general way, the oil-lines follow the axes of the folds referred to.

2.1.33. Figs. 4 and 5 represent cross-sections bisecting portions of the Puente Hills which are a little more than 3 miles apart. In Fig. 5 two distinct folds are shown, and in Fig. 4 two distinct folds and two minor plications. There are also other minor plications in the territory represented, but it would complicate the figures too much to delineate them. It is apparent that the outer slopes of these folds are formed of conglomerate, and the inner slopes of the underlying shales and sandstones. There also is a very slight interplication of conglomerate, which is shown in Fig. A, i. e., in the plan of the territory referred to, but not in Figs. 4 and 5.

It is appropriate, therefore, to regard that portion of the Puente Hills through which cross-sections 2, 3, 4, and 5 are drawn as constituting an anticlinal fold, with secondary folds running parallel to its axis.

2.1.34. The arrows in Figs. 4 and 5 show that there is considerable irregularity in the dip and strike of the different formations. In a general way, the prevailing strike of the shales and sandstones is west of north, while that of the conglomerate is sometimes east of north. These features may be noted at several points in the Puente Hills, although both the east of north strike and west of north strike are more or less common to both the conglomerates and underlying formations. For the most part the conglomerate is much less disturbed than the underlying shales; to some extent this may be accounted for by the fact that the conglomerate is much the stronger formation.

2.1.35. The contour of the hills between the Puente wells and Brea Cañon suggests that fold XX is a continuation of fold AA, and fold ZZ of fold BB. A careful examination of the territory, however, shows that if line XX were extended westward it would coincide with BB

FIG. 5.

CROSS SECTION BETWEEN STATION 261A NEAR S.W. COR. OF SEC. 32 & STATION 236 NEAR N.E. COR. SEC. 29. T. 2 S. R 10 W. S. B. M.

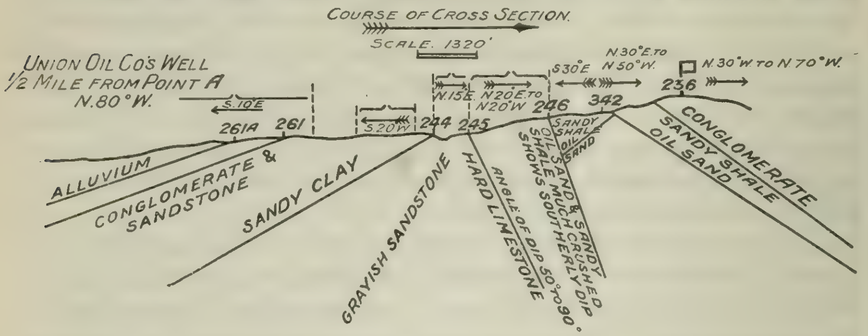


FIG. 6.

CROSS SECTION THROUGH FOLD "X.X."

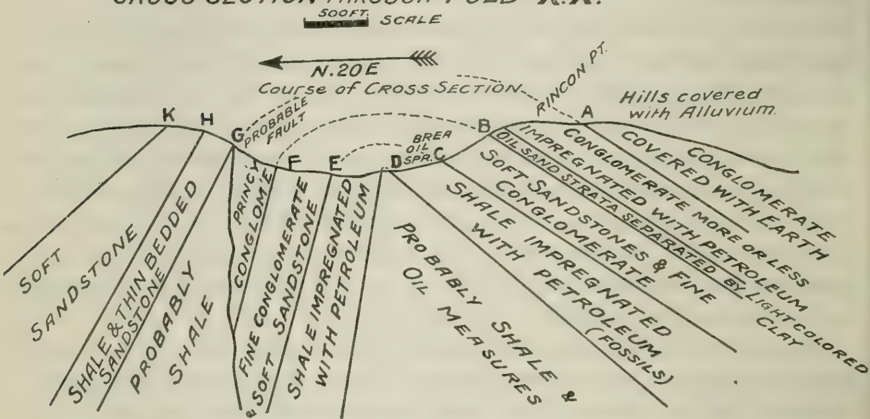


FIG. 7.

CROSS SECTION THROUGH FOOT HILLS, S. SIDE SANTA ANA RIVER, ORANGE CO.

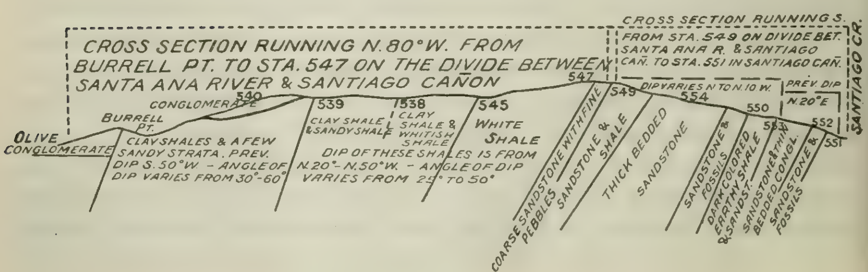


PHOTO 5. SANTA FÉ OIL-WELLS, FULLERTON OIL-FIELD, ORANGE COUNTY.
(Photo taken in 1898.)

PHOTO 6. VIEW IN EASTERN OIL-FIELD, CITY OF LOS ANGELES.

rather than with AA. This might be accounted for by the difference in elevation and the inclination of the axis of fold XX, but in view of the broken character of the structure between the Puente wells and Brea Cañon it would be a hazardous generalization.

At the south end of Brea Cañon there is a well-marked anticlinal fold, the axis of which has a strike of about S. 76° E. The probable strike of the axis of this fold is shown in Fig. 1 by divergent arrows and in Fig. A by line XX. A short distance west of the junction of Brea Cañon and the Spadra Road, fold XX is disturbed by a cross-fold, the axis of which has a strike of north of east, as is shown by rock-exposures along the Spadra Road.

Along the axis of fold XX there is a series of oil-springs. Investigation at the south end of Brea Cañon leads to the conclusion that the axis of this fold is inclined to the north at an angle of about 25° from the vertical; for on the north side of the fold the strata dip N. 20° E. at an angle of about 75°, and on the south side of the fold the dip is S. 10° E. at an angle of about 40°.

2.1.36. Fig. 6 represents a cross-section through fold XX. It is drawn from observation at the south end of Brea Cañon, which is locally known as Rincon de la Brea. As noted in Fig. 6, the delineation of the north limb of this fold must be accepted tentatively, for the scanty rock-exposures indicate a complex structure. Analysis of Fig. 6 shows as follows: Between points A and B the formation is conglomerate, the lower portion of which is more or less impregnated with petroleum. Near point B there are two strata of oil-sand, which are respectively 2′ and 1′ thick, and are separated by light-colored clay. The oil-sand is reddish in color, and contains granite and quartz pebbles. The oil-sand rests on soft sandstone and fine conglomerate, from which the writer obtained a small collection of fossils representing the Middle Neocene age. (See Bulletin No. 11, pages 79 and 80.) The soft sandstone rests on a grayish bituminous clay-shale, which is shown between points C and D, Fig. 6. The last-mentioned rock appears to be the source of the oil-springs previously mentioned as extending along the south side of Brea Cañon. Near the top of this deposit of shale at the Rincon de la Brea is a thin stratum of fossiliferous sandstone, from which the writer obtained several fossils which are referred by Dr. Merriam to the Middle Neocene age. (See table of fossils No. III.) In the center of that portion of Brea Cañon shown in Fig. 6 there are no rock-exposures. On the north side of the cañon, as indicated between points E, F, and G, there are strata of sandstone and conglomerate similar in appearance to the sandstones and conglomerate on the south side of Brea Cañon. Between points G and H the formation is shale and soft sandstone, which probably belong to the same geological horizon as do the shales exposed between points C and D on the

south side of Brea Cañon. The upper portion of the shale between points G and H passes into thin-bedded, reddish sandstone, or sandy shale, intercalated with soft whitish material, which resembles diatomaceous earth. It will be observed that on the south side of Brea Cañon there is an orderly sequence of conglomerate and sandstone overlying shale, which, as before demonstrated, is normally the relative position of these formations in the Puente Hills. On the north side of the cañon the shale appears to overlie the conglomerate. It is not improbable that this apparent reversal is due to a fault such as that represented at point G, Fig. 6. The shales and thin-bedded sandstone between points G and H show no evidence of petroleum. As previously mentioned, the rocks exposed on the north side of the fold at the point under discussion indicate a complex structure; moreover, the rocks exposed on the north side of the fold do not correspond sufficiently to the strata exposed on the south side of the fold to warrant the divergent strata shown in Fig. 6 being connected by an air-saddle.

2.1.37. Southeast of Brea Cañon the fold marked by line ZZ (see Fig. A) traverses the mountain which lies to the north of the Santa Fé oil-wells. (See Photo No. 5.) Its course is somewhat obscure, but it appears to be in line with Station 40 in Clapp Cañon, where the axis of a fold can be observed. The formation immediately to the north of the Santa Fé oil-wells (see Fig. A) is principally sandstone, and the geological position of the exposed rocks is near the contact of the sandstone and shale formation. Since this locality was visited by the writer, wells have been drilled to the north of the wells of the Santa Fé Railroad Company.

South of fold XX and southeast of Brea Cañon, a series of oil-springs and beds of brea extend in a southeasterly direction toward the wells of the Santa Fé Railroad Company. These springs and brea beds mark the axis of a fold which is indicated by line ZZ. Along the fold the formation is shale and soft sandstone overlain by conglomerate, and most of the strata show a dip of from 60° to 80°. The wells of the Santa Fé Railroad Company are situated on this fold. (See wells of the Santa Fé Railroad Company.) In Telegraph Cañon the angle at which the strata dip gradually lessens to about 50°. East of Telegraph Cañon fold ZZ is very difficult to trace, and as the Santa Ana River is approached the geological structure becomes very complex.

2.1.38. The hills immediately west of the Santa Ana River are composed principally of whitish sandstone, corresponding to the whitish sandstone previously described. The writer did not find any springs of petroleum or brea beds east of Telegraph Cañon. South of Telegraph Cañon a series of hills, composed principally of conglomerate, slope down to the valley lands.

2.1.39. North of Telegraph Cañon the Puente Hills extend for a distance of about 7 miles toward the Chino Valley. For the most part they consist of sandstone, and constitute rough grazing land, and a large area is comprised by the Chino ranch.

2.1.40. Carbonne and Clapp cañons cut through hills nearly at right angles to the prevailing strike of the formation. The exposed rocks are principally sandstones. Between Stations 31 and 30 in Carbonne Cañon the formation consists principally of slaty shale similar in appearance to that seen between Stations 22 and 23, north of the wells of the Central Oil Company. (See Fig. 4.) This shale varies from clayey to sandy; in some places it is very silicious, and some samples show a calcareous reaction with acid; it is usually fissile, frequently presenting a slaty cleavage; more rarely it is thick-bedded; and, in some instances, it loses its shaly structure. Exposures of similar shale may be seen at some places on the Chino ranch. Farther to the north-east up Carbonne Cañon, between Station 30 and the Hiltscher ranch, the formation is principally sandstone. This sandstone varies in color from white to yellowish or light brown, and some of it is composed of mealy-looking grains which are very characteristic. In most places where it has been exposed to the weather it is soft and friable; but beneath the surface of the ground it is moderately hard; it resembles the Miocene (Lower Neocene) sandstone observed in Santiago Cañon, as hereinafter noted. North of the Hiltscher ranch, most of the exposed rocks are sandstone. There are, also, a few places where sandy and clayey shales are seen, resting on bituminous sandstone.

2.1.41. Bituminous sandstone is exposed at several points on the Chino ranch. In most places the outcropping bituminous rocks have no odor of petroleum; but the fresh-broken rock shows the brown pulverulent surface characteristic of oil-sand, and by a little digging rock smelling of petroleum can be found. On the Chino ranch bituminous sandstone may be observed at the following places: In a ravine about a quarter of a mile west of the well drilled by the Chino Valley Beet Sugar Company (see Chino Well No. 1, Fig. A) there are ledges of bituminous sandstone about 10′ or more in thickness, which at one time must have been saturated with oil. (See record of Chino Well No. 1.) After breaking away the weathered surface, specimens can be obtained which smell slightly of petroleum. At Station 200, near Chino Well No. 2, there is another outcrop of bituminous sandstone, and a seepage of heavy petroleum. The exposed sandstone is about 20′ thick, and the dip is N. 50° E., at an angle of about 25°. At this point there is an upper deposit of bituminous sandstone of less thickness than the main body, and separated from the latter by a stratum of barren sandstone. At Station 40 a ledge of bituminous sandstone is exposed, and there is a spring of heavy oil. A 1000′ well was drilled near this point. (See record of Gird well.)

2.1.42. At Gird's quarry, on the road to Brea Cañon, the bituminous sandstone shows a thickness of about 40′. In the lower portion of the quarry the sandstone is saturated with oil. In Rattlesnake Cañon, northwest of Chino Well No. 2, there are extensive ledges of bituminous sandstone, which aggregate a thickness of more than 30′. There are also several places in the vicinity of Gird's quarry where bituminous sandstone is exposed.

2.1.43. In the portion of the Puente Hills comprised within the Chino ranch, the prevailing strike of the formation is west of north. The lines of geological formation resemble faults running in the direction of the strike of the formation, and the block structure, although on rather a small scale, is apparent. Near Gird's quarry of bituminous sandstone the formation is traversed by short folds, along which the bituminous sandstone crops out. The dip of the formation is at a very low angle, in most places only 10° or 15°.

About a quarter of a mile south of Gird's quarry there is a line of disturbances of some importance; in places it exhibits more or less of an anticlinal structure; it is marked DD on Fig. A. Bituminous sandstone crops out at several places along this line. At one point near Station 200 a prospect well was drilled by the Chino Valley Beet Sugar Company, but without success. (See record of Chino Well No. 2.)

The lower foothills of the Puente range within the boundaries of the Chino ranch are covered with alluvium. The writer did not examine them east of the road leading from Gird's quarry to Chino.

2.1.44. The higher portions of the Puente Hills between Carbonne Cañon and the Cañada del Rodeo, which territory includes a portion of the Chino ranch, consist of rough mountainous grazing land. The most prevalent formation is thick-bedded sandstone, whitish or brownish in color, and resembling the Miocene (Lower Neocene) sandstone in Santiago Cañon. In a few places the formation is shale. At Station 201, near to where the Brea Cañon road crosses the San Bernardino county line, the sandstone is impregnated with brown pulverulent matter, and resembles dry oil-sand. The geological structure is quite complex. In some places the strike of the formation is east of north, and in others west of north. The crushing which the rocks of the Puente Hills have undergone is illustrated in many places where the surface of the strata is exposed, as is shown in Photo No. 2.

2.1.45. A reconnaissance along that portion of the north slope of the Puente Hills lying west of the town of Chino, showed that the foothills are composed principally of shale, which, south of Pomona, appears to rest on a gray or brown sandstone.

2.1.46. Pomona Hill is 1476′ in height; it is about 2 miles southwest of the town of Pomona. This hill and the ridge on which it is situated are formed of very hard sandstone, which, in one or two places, contains

veins of calcite. There are also a few strata of crystalline limestone. The most northerly ridge in this portion of the Puente Hills is composed principally of eruptive rock (laminated rhyolite). (See Stations 271 and 272, Fig. A; also Fig. 1.)

On the boulevards in the southwest corner of the limits of Pomona, and at the foot of the ridge of rhyolite previously mentioned, the bedrock is granite. (See Fig. A.) South of Pomona there is a narrow valley occupied by marshy land, with numerous springs which are the source of Brea Cañon Creek. On the Wright & Lynch ranch, west of Pomona Hill, the foothills are composed of shale, resting on sandstone resembling that seen in the higher portions of the hills. There is also in this locality a somewhat extensive exposure of conglomerate, which probably belongs to the same geological horizon as the sandstones.

At Station 273, on the Lynch & Wright ranch, the shale is interbedded with oil-sand, and the sandstone immediately underlying the shale is more or less impregnated with bituminous matter. The prevailing strike of these rocks is west of north, and the angle of the dip is about 20° or less. No springs of liquid petroleum were observed in this locality. West of Station 273 the foothills are covered with alluvium. In a cañon running northwest of the water tunnel of the Puente Oil Company thick strata of sandstone are exposed, the dip being a little west of north at an angle of about 30°.

2.1.47. Immediately north of the Puente oil-wells the topography and the exposed rocks indicate considerable geological disturbance, probably in the nature of faults, running nearly in the direction of the strike of the formation (i. e., a little east of north). The formation is shale and sandstone.

In the creek which runs north from the Puente wells, ledges of thick-bedded sandstones crop out, and a similar sandstone is exposed on both sides of a trail which leads from the crest of the Puente Hills toward the Puente ranch-house. The sandstone is overlain by shale, in which are strata of oil-sand, as shown at Station 181, Fig. A. The shale is capped with conglomerate. (Figs. 1, A, and 5.) The prevailing dip of the formation in this portion of the Puente Hills is west of north. This is probably occasioned by a cross-fold which traverses the Puente Hills at this point, and complicates the geological structure. The conglomerate constitutes an elevated ridge, which rises to an altitude of more than 1300′. From this ridge a slope of grazing land descends toward the north; the underlying rocks being conglomerate, overlain in the lowest tier of hills by bluish micaceous clay. The conglomerate can be traced through the foothills of Station 36, where it is overlain by a grayish clayey sandstone containing much mica and some fossils.

Farther westward, erosion has worn down the hills, lessening their width and elevation and exposing the underlying shales and sandstones.

At Workman Hill, north of the Central oil-wells, the hills rise to an elevation of 1391′; and the north slope of the hills is formed of conglomerate underlain by shale. A stratum of oil-sand is exposed in the cañon at the south base of Workman Hill.

From Workman Hill to the west extremity of the Puente Hills, the north slope of the hills is principally conglomerate, with a few strata of sandstone. In some places the sandstone is impregnated with bituminous matter, and there are springs of sulphureted water which deposit a tufa containing bituminous matter.

As previously stated, the dip of the formation at the west end of the Puente Hills indicates a cross-fold or the nosing out of a fold of greater magnitude than those which have been individually described.

2.1.48. The west extremity of the Puente Hills descends somewhat abruptly to the San Gabriel River. The exposed rocks for the most part belong to those heretofore classed as the conglomerate series, but they are much obscured by alluvium. (See Fig. A.) In the lower portion of Sycamore Cañon, the clay-shale crops out in several places, and it is overlain by conglomerate.

About a mile north of the village of Whittier there are deposits of sulphur, which, in 1889, were mined by C. Prager of Los Angeles. These deposits present the usual characteristics of solfataric origin.* (See Solfataric Action, Bulletin No. 11.) It is probable that these sulphur deposits indicate a fault or fissure. It is noteworthy that if the line of disturbance marked AA on Fig. A were extended westward, it would strike the sulphur deposits. The sulphurous rocks consist of decomposed shale impregnated with sulphur and a little bituminous matter.

CHAPTER 2.

THE FOOTHILLS EAST OF THE SANTA ANA RIVER.

2.2.1. Although the line of research to which the writer was assigned did not extend to the Santa Ana River, he made a reconnaissance of a portion of the foothills of the Santa Ana Mountains, the reason being that the rocks are much better exposed in the Santa Ana Mountains than they are in the Puente Hills. As previously mentioned, the Santa Ana Mountains are separated from the Puente Hills by the Santa Ana River. These mountains at their northern end are formed of eruptive rock and sedimentary rock of Tertiary and Cretaceous age. (See Table III, at the end of this Bulletin.) The Cretaceous rocks con-

*The term "solfataric" as here used is not meant to imply volcanic action, but simply chemical phenomena similar to those incidental to volcanic solfataras.

tain coal veins, which have been mined for many years. The portion of the foothills of the Santa Ana Mountains which was specially examined by the writer, is between the Santa Ana River and Santiago Cañon, and extends from the village of Olive to the west line of the Rancho Santiago de Santa Ana. Throughout this area the formations correspond to those seen in the Puente Hills.

As this locality shows by far the best sequence of the conglomerate shale and sandstone formations which has come under the notice of the writer, it is in order to describe it in detail.

2.2.2. Fig. B represents the ground plan of certain portions of the hills constituting the divide between the Santiago and the Santa Ana rivers, and Fig. 7 represents two cross-sections through these hills. The section on the left hand is drawn from observation between Burruel Point and Station 547.

At Burruel Point the exposed rocks are conglomerate, resting on clay-shale interbedded with thin strata of sandstone. No actual contact between the conglomerate and the underlying shale is observed; but the following data suggest a non-conformability between the conglomerate and the shale: At Station 543 the dip of the conglomerate is N. 10° W., at an angle of 25°; in the cañon below (i. e., between Stations 540 and 541) the prevailing dip of the shale varies from N. 40° W. to S. 50° W., at angles varying from 30° to 60°. At Stations 543 and 340 patches of conglomerate constitute outliers on the shale. At Station 340 a few Middle Neocene fossils were obtained (No. 15, Table III). At Station 338 the shale becomes sandy and the direction of the dip changes. At Station 339 the formation is a tough blue clay-shale. Near Station 545 the blue clay becomes whitish, and at Station 545 passes into a white shale, which is exposed between Stations 545 and 547. The white shale rests upon a coarse sandstone. This portion of the diagram represents a cross-section between Burruel Point and Station 547. From investigation between these points it is obvious that the formations referred to rest one on another in the order named; but the shales have been so much disturbed that the locality is an unfavorable one in which to estimate their thickness, or to determine their conformability or non-conformability with the rocks inclosing them. In the opinion of the writer, the various kinds of shale mentioned rest conformably one on another, gradually passing from yellowish clay-shale to sandy shale, to tough blue shale, to whitish shale, and to white shale. Whether the whiteness of the shale is due to the character of the sediments from which it is formed, or whether it results from the alteration of the dark-colored shale, is a matter for further investigation. As set forth in Bulletin No. 11, Part 2, Chapter 1, Paragraph 38, and in Part 3, Chapter 1, Paragraph 3, a similar looking white shale is formed in Ventura and Santa Barbara counties by the alteration of dark-colored

shale. No seepage of petroleum or oil-sand was observed, but these shales in every way resembled those which inclose the oil-sands in the Puente Hills. As is shown in Fig. B, the shales referred to rest on a deposit of sandstone. Fig. 7 is made up of two parts: (1) A portion already described, representing a cross-section between Burruel Point and Station 547 on the ridge between the Santa Ana River and the Santiago Creek; (2) A portion representing a cross-section between Station 549, on the said ridge, and Station 551 in the Santiago Cañon. The courses of these sections as shown in these portions of Fig. B are dissimilar, the first being N. 80° W., which appears to be the average dip of the shale between Burruel Point and Station 549; the second being nearly due north, which appears to be the average dip of the sandstone between Stations 549 and 551. This dissimilarity of dip is probably due to non-conformability. From observations on these formations in other localities, it appears probable that the shales overlap the sandstones as hereinafter described. Fig. 7 must not be regarded as indicating the thickness of the shale, for as shown in Fig. B the angle of the dip varies and there are several local disturbances between Burruel Point and Station 549.

2.2.3. The sandstone formation between Stations 549 and 551 is more than 5000′ thick, and about 1300′ of this thickness is represented by strata of sand and conglomerate, as indicated between Stations 553 and 551. These rocks show a somewhat different dip to that of the overlying sandstones; but, in the opinion of the writer, this may be accounted for by local disturbance. Between Stations 549 and 550 the sandstone is for the most part thick-bedded, and grayish, whitish, or yellowish in color; when the sandstone comprising some of the strata is freshly broken it presents a mealy-looking surface, which is very characteristic. At Station 550 the sandstone contains Miocene fossils. (See fossils Nos. 12, 20, 22, 23, 24, 31, Table II.)

2.2.4. Between Stations 550 and 553 the formation is a dark-colored, earth-like shale, interstratified with sandstone; the shale contains a great deal of mica. It is said that at some depth below the surface this shale has been found to be more or less impregnated with petroleum.

2.2.5. Between Stations 553 and 551 the sandstone is comparatively thin-bedded, and is interstratified with conglomerate. As shown in Fig. 7 and Fig. B, the dip of this strata is somewhat different from that of the sandstone overlying the shale. At Station 551 a stratum of calcareous sandstone, containing a few poorly preserved fossils of Miocene age, is exposed.

2.2.6. From the foregoing, it appears that the rocks forming the Puente Hills may be divided into three formations: conglomerates, shales, and sandstones. These formations rest one on another in the order named, the conglomerate being at the top. They represent a

geological age extending through a portion of the Lower and the Middle Neocene.* The productive oil-yielding formations consist of certain strata of sandstone interbedding the lower portion of the shale formation of Middle Neocene age, and it is not improbable that the sandstones underlying the silicious shales may also contain petroleum in valuable quantities.

The formations named are traversed by two series of folds, namely: folds having a strike of west of north; and cross-folds having a strike of east of north. As previously noted, the cross-folding has resulted in the formation of blocks, and these have been subsequently tilted.

The southern portion of the Puente Hills constitutes an anticlinal ridge, the structure of which is modified by faults and subordinate folds. The oil-lines which have thus far been developed appear to follow the axes of folds and blocks of strata which have a strike of west of north, and in a general way their course corresponds to the axis of the anticlinal ridge to which reference has been made. At many places along the anticlinal ridge there are springs of oil, exudations of asphaltum, and rock impregnated with petroleum. Especially is this the case at and near the contact of the sandstone and the overlying shale.

From the evidence at hand, it seems that the oil companies operating in the Puente Hills will make the best progress by following the axes of the folds and the strike of blocks of strata on which remunerative wells are situated, by carefully fixing the site of new wells with reference to the dip and strike of the formation as determined by methods hereinafter described; and by restricting the distance between old and new wells to very moderate limits. As a general proposition, the most regular oil-lines will be found on the outer slopes of the main anticlinal fold or ridge herein described, while along the axis of the ridge the oil-lines are likely to be erratic.

In the central and northern portions of the Puente Hills, oil-springs are seldom met with, but in some places the sandstone is more or less impregnated with petroleum, and at the surface it is for the most part a dry, oil-stained rock. Wells hitherto drilled for the purpose of testing these dry, oil-stained sandstones, have been unsuccessful, but it must not be taken for granted that these oil-stained sandstones have been thoroughly prospected.

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* At a few points, there are also some rocks which may be of later age.

PART 3.

LOS ANGELES AND ITS SUBURBS, SAN PEDRO PENINSULA, SAN FERNANDO DISTRICT, TERRITORY BETWEEN NEWPORT IN ORANGE COUNTY AND THE SAN DIEGO COUNTY LINE, AND PROSPECT WELLS IN SAN DIEGO COUNTY.

CHAPTER 1.

GEOLOGICAL FORMATION BETWEEN PUENTE HILLS AND THE LOS ANGELES OIL-FIELD.

3.1.1. There are no remunerative wells between the Puente Hills and the City of Los Angeles. West of the San Gabriel River broad mesas of arable land extend toward Los Angeles, but they afford no opportunity for geological examination. The Rapetto Hills divide the mesa lands from the San Gabriel Valley. These hills do not exceed an altitude of about 700′, and are, for the most part, covered with alluvium. There are sufficient rock-exposures to show that the bedrock is conglomerate, but not sufficient to demonstrate the geological structure. In the south edge of these hills there are a few places where clay-shales are exposed.

3.1.2. The Arctic Oil Company of San Francisco drilled three wells on the Garvey ranch in the Rapetto Hills. The depths of these wells are respectively 600′, 1100′, and 1200′. It is said that after penetrating the conglomerate the formation was clay-shale, but that no petroleum was discovered. The wells have been abandoned.

3.1.3. On the mesa land, in wells sunk for water on the Hellman ranch, near the cross roads south of the Rapetto Hills (see Fig. A), inflammable gas was struck in sufficient quantities to be utilized locally for light and fuel. These wells are less than 200′ deep. It is said that the formation penetrated is principally clay or clay-shale. It is also said that in a well about half a mile northwest of the Hellman wells, oil-bearing shale was struck at a depth of about 100′.

3.1.4. In the hills to the north of the mesa land, the conglomerate extends almost to Monterey Cañon, but the rock exposures are few and far between. West of Monterey Cañon the formation is clay-shale overlain by conglomerate, and a series of earth-covered hills reach to the city limits of Los Angeles.

3.1.5. Within the city limits there are rock-exposures on Soto Street and near Reservoir No. 6 (see Fig. C), showing this reservoir to be situated on the axis of an anticlinal fold, which has a strike of about N. 80° W. A short distance down the south slope of this fold is a seepage of petroleum. A well was drilled at this point by Chandler in 1894. The formation is shale. It is said that there was a good showing of heavy oil at a depth of 150′; but the well was abandoned at 335′, on account of water. In 1898, a well was drilled on the north side of this fold by the De Soto Oil Company, and clay-shale penetrated for 700′. It is said that no oil was struck. Farther westward along the Rapid Transit Railroad there were seepages of petroleum. The formation is shale, and in several places strata of oil-sand are exposed. The strata dip a little west of south at an angle of from 30° to 50°.

Oil-yielding strata have been struck in more than one well in this portion of Los Angeles. Several years ago a well was sunk on the Rapid Transit Railroad, a short distance west of Prospect Park. It is said that at a depth of about 400′ there was a good showing of oil, but that at a depth of 600′ a body of water was struck which "drowned out" the well. In a well sunk for water on property of F. E. Bland, on Judson Street, near State Street, oil was found at a depth of 80′. Also, in a well sunk on the property of C. M. Johnson, on State Street, near its intersection with Bailey, oil was found at a depth of 40′. In a well sunk by Scott & Loftus on St. Louis Street, between Emerson and Scott streets, oil-sand was struck at 560′, but subsequently much water was encountered. Messrs. Scott & Loftus also sunk an 800′ well on Magnolia Avenue, about 400′ east of Soto Street, but only obtained traces of oil. (See record of wells.)

3.1.6. On the west side of the Los Angeles River, the glimpses of the rock formation which can be obtained among the houses show that the clay-shales constitute the bedrock throughout the greater portion of the city. Near the High School and the State Normal School, and possibly in other places, there are "outliers" of conglomerate which rest nonconformably on the shale. These shales outcrop at several places in the western borders of Los Angeles; and on the coast-line at Santa Monica they are represented by the formations described in Bulletin No. 11, 1.1.14. These shales rest on thick strata of sandstone, which are well exposed along the water company's ditch, on the east side of Elysian Park. These sandstones resemble the sandstones seen in Santiago Cañon containing Miocene fossils, which are referable to the Lower Neocene division of the Tertiary system in California.

3.1.7. Throughout a great portion of Elysian Park, on the west side of the Los Angeles River, and north of the San Gabriel branch of the S. P. R. R., on the east side of this river, the formation is principally sandstone, resembling that seen at the eastern end of the Puente Hills

and between the Santiago Cañon and the Santa Ana River. There are places, however, where patches of the shale formation either rest as outliers on the sandstone or are interfolded with it.

3.1.8. North of East Lake Park these older rocks are traversed by a fold, the axis of which, if extended westward across the Los Angeles River, would nearly coincide with a line of fault or fissure which runs through the northern extremity of the Los Angeles oil-fields.

Some attempts have been made to prospect these older rocks, but at this writing no remunerative wells have been obtained. A short distance north of Reservoir No. 5, a well was sunk to a depth of 840′ by Headly of Los Angeles; no oil; abandoned. A 640′ well was drilled by T. M. Wilkinson, about a quarter of a mile east of Reservoir No. 5; traces of oil were obtained, but the well was abandoned. (See record of the Wilkinson well.) A well was also drilled at Warneck Park, in East Los Angeles. The formation penetrated is shale; only traces of oil were obtained.

CHAPTER 2.

THE LOS ANGELES OIL-FIELD, 1897-1899, INCLUSIVE.

3.2.1. As the character of the formation in the Second-Street Park oil-field, now called the Central or Old field (see Photo No. 7), was fully described in Bulletin No. 11, it is in order to relate such developments only as are subsequent to those mentioned in that Bulletin. The western end of the field was extended to the corner of Quebec Street and Ocean View Avenue (now called Miramar Street), where trouble was experienced from broken formation, quicksand, and water. These obstacles, and legal difficulties resulting from a complication of miners' rights with city ordinances, for a time discouraged further development in this direction. Eventually prospecting was continued in a westerly direction along what had been shown to be the strike of the formation; this resulted in the developments recorded at the end of this chapter.

In the old field many new wells were sunk in the interspace between the wells previously drilled. Exploitation to a greater depth than that of most of the wells drilled prior to 1896 showed that there was a second stratum of oil-sand. East of Belmont Avenue, this second stratum of oil-sand was found to be productive wherever it was struck, at a depth less than 900′, and west of Belmont Avenue at a depth less than 1050′. Below these depths it was found to contain water.

The relative values of these oil-sands compare as follows: First oil-sand, 125′ thick, about 45′ productive; second oil-sand, 30′ thick, all productive.

PHOTO 7. THE CENTRAL OIL-FIELD, CITY OF LOS ANGELES.

PHOTO 8. THE EASTERN OIL-FIELD, CITY OF LOS ANGELES.

The eastern end of the field was extended until the north line of geological disturbances, mentioned in Bulletin No. 11, was reached at the corner of Victor Street and Bellevue Avenue, near the Sisters' Hospital; then great trouble was experienced from broken formation, quicksand, and water. Subsequently, prospecting was recommenced a few blocks farther eastward, which resulted in the discovery of the eastern extension of the Los Angeles oil-fields. (See Photo No. 8.) In this connection see Bulletin No. 11, 1.1.26 and 1.1.28.

3.2.2. The first well drilled in the new field was sunk by Maier & Zobelein, at the corner of Adobe and College streets. This well was completed in November, 1896, and as soon as it was found to be a success, there was a rush for the new field. By the middle of 1897 the wells in the new field were almost as closely crowded as they were in the old field.

Fig. D shows the relative positions of the old and the new fields; i. e., the Central field, and the Eastern Extension, as they are now called. The black dots show the wells drilled before the end of 1896, and the open circles represent wells drilled during 1897.

3.2.3. The formations penetrated in the Central and in the Eastern Extension fields are very similar. They differ somewhat in different parts of the fields, but an idea of their similarity can be gathered from a comparison of the following records:

Typical Record of Formation in Old, or Central, Field.		*Record of Formation in New Field, or Eastern Extension.*	
Given by Mr. Doheny.		Given by Mr. Herschey.	
Sandy and clayey shale with strata of hard rock, to	650′	Sandy shale, to	325′
Oil-sand (oil 19° B.) interstratified with sandy clay, to	775′	Clay shale (bituminous) to	380′
Tough blue clay, to	975′	Hard shale, to	383′
Oil-sand (oil 16° B.) to	1020′	Clay-shale, to	395′
Sand, with water.		Oil-sand (oil 18.75° B.) to	450′
		Hard shale, to	453′
		Tough clay-shale, to	483′
		Hard shale, to	485′
		Oil-sand (oil 16° B.) to	510′
		Hard shale	512′
		Tough clay-shale, to	552′

3.2.4. The question as to the direction in which the Los Angeles oil-fields were likely to extend was one of great importance, and at every stage in the development of these oil-fields this subject has attracted the greatest public interest. It was discussed in Bulletin No. 11, as far as the evidence in hand warranted, and it was stated that "If the oil-line on which the Second-Street Park oil-fields is situated be extended westward, it would pass a short distance south of the Baptist University." (See Bulletin No. 11, 1.1.25 and 1.1.26.) Events since the publication of the Bulletin named have corroborated what is expressed in the paragraphs referred to.

When the field-work on which the current Bulletin is based was in progress, excitement ran high lest the course of the oil-line should extend from the old oil-fields to West Lake Park; and in response to many requests with regard to the matter the writer has collected a large mass of data pertaining to what were then called the new and the old fields, especially with regard to the depth below the city datum at which the oil-sand has been struck in the different wells. From this data he estimated the dip and the strike of the oil in both fields, and drew certain lines indicating the slope of the oil-sand, as shown in Fig. D. The result is a picture, illustrating the structural conditions pertaining to the oil-sands in both fields.

Since the matter was of immediate interest and, owing to the State Printing Office being closed, there was no likelihood of an early publication of the result of the writer's investigations, he made public his conclusions by means of lectures, which were reported in full by the Los Angeles papers, and placed maps of the localities under discussion in the Chamber of Commerce at Los Angeles, and in other public institutions.

3.2.5. An analysis of Fig. D shows as follows: At the western extremity of the Central field, the formation is disturbed, and the angle of the dip ranges from 40° to 50°, both of which circumstances being in keeping with the surface indications. Farther eastward the formation is more regular, and the angle of the dip increases. At Second-Street Park, more geological disturbance is manifested, the angle of the dip increases, and the strike is irregular, the cause of the disturbances being a cross-fold, which intersects Court Street near Douglas Street. Farther eastward the formation becomes more regular, until the eastern extremity of the field is reached; here the trouble again commences, the cause being a cross-fold or fault, or both.

3.2.6. In the Eastern Extension the formation is more irregular, and the angle of the dip is less than in the Central field. The most regular portion is the central portion of this field, which extends from the Sisters' Hospital toward the corner of Bernard and Yale streets. Along this line the angle of the dip lessens, until at Yale Street it is only about 10°. East of Yale Street the surface of the oil-sand is at first undulating, and then more violently disturbed. In the eastern extremity of the field, this disturbance is particularly well marked. In the northern corner of the Eastern Extension the immediate cause of the disturbance appears to be a fault, which may be seen at the corner of Bernard and Adobe streets, and in Chavez Ravine. This fault probably extends to the corner of Hinton Street and Beaudry Avenue, where the formation for a short space dips to the north.

3.2.7. The course of the contour lines shown in Fig. D corresponds to the prevailing strike of the oil-sand, which is practically N. 85° W. The contour lines also set forth the relation of the old and the new oil-

fields. Thus, if we take any line in the Eastern Extension such as the one along which the oil-sand could be struck at a depth of 400′ below the city datum, and carry it westward, it would pass to the north of the Second-Street Park oil-field. Again, if we take any line in the Second-Street Park oil-field, such as the one along which the oil-sand could be struck at the depth of 500′ below the city datum; and carry it eastward, it would pass to the south of the Eastern Extension.

3.2.8. This incongruity may be explained by either of the following causes: (1) It may be occasioned by a fault running in the direction of the dip of the formation; (2) It may be occasioned by a fault running in the direction of the strike of the formation; (3) It may be occasioned by an oil-yielding stratum underlying those which have been struck in the Second-Street Park oil-field.

If the first hypothesis is true, then there is no extension of the eastern end of the Central field, nor of the western end of the Eastern Extension. This is the least probable of the three explanations.

If the second or third is true, it is not improbable that an oil-line would extend from the Eastern Extension beneath the Sisters' Hospital toward the corner of Edgeware Road and Temple Street, running parallel to, and north of, the Central field. There might also be an oil-line running east of the Central field, toward the corner of Alpine Street and Bunker Hill Avenue. Furthermore, a line drawn along the strike of the formation eastward, from the northern limit of the Eastern Extension, would cross the river near the Main-Street bridge, and a line drawn along the strike of the formation eastward from the south limit of the Central field would cross the river a short distance south of the Alhambra-Street bridge. The evidence which supports the hypothesis that there is a fault running in the direction of the strike of the formation between the Central field and the Eastern Extension, is as follows: At the northeast extremity of the Central field, namely, at the corner of Victor Street and Bellevue Avenue, the exposed rocks show a sudden increase in the angle of the dip, from 35° to about 70°; and more directly eastward from the said corner and south of the Eastern Extension, prospectors have found a broken, water-soaked territory, such as one might expect in the vicinity of a fault.

3.2.9. From the foregoing it appears that a body of clay-shale, which, in some places, has been found to contain oil-yielding strata, underlies the greater portion of the City of Los Angeles. This shale, as previously mentioned, constitutes a large portion of the Puente Hills, and is probably the bedrock in the mesa lands between Los Angeles and Whittier; it contains fossils representing the Middle Neocene epoch. As hereinafter shown, the upper oil-measures of the San Joaquin Valley belong to this geological horizon.

The facts herein set forth demonstrate that there is a strip of territory

at Los Angeles within which oil-lines have been developed, and that there are numerous other evidences of petroleum, and that this strip of territory extends eastward from the Baptist College and the Maltman wells toward the Second-Street Park oil-field, and thence toward the Scott & Loftus well on St. Louis Street in East Los Angeles.

It is not to be supposed that an unbroken oil-line extends between the points named, for surface indications and drilling records show that this strip of territory is traversed by independent lines of minor geological disturbance, the course of which, in some instances, does not coincide with the prevailing strike of the formation. But it is by no means improbable that oil-lines besides those already discovered may be developed in the strip of territory indicated, and that the extent of such oil-lines would be governed by faults or minor folds.

3.2.10. From the records of the oil-wells in Los Angeles and in the Puente Hills, and from the fact that outcropping oil-sands and oil-springs are, in many instances, found near the contact of the shales and the underlying sandstones, it is evident that remunerative oil-sands interstratify the lower portion of the shale formation, and in some instances probably constitute the uppermost strata of the underlying sandstones.

From what has just been stated it follows that wells sunk in the shale should penetrate that formation and ought not to be abandoned before the sandstone, which in the territory under consideration underlies the shale, has been reached. The detailed observations concerning the dip and strike of the oil-sand at Los Angeles, recorded in this report, corroborate the statements made in Bulletin No. 11 of the California State Mining Bureau.

As before mentioned, the average strike of the oil-sand in both the oil-fields at Los Angeles is N. 85° W., or S. 85° E. If a line were drawn S. 85° E., from the corner of Scott and Figueroa streets, in the Central field, it would cross the Los Angeles River about 300′ south of the railroad bridge at Alhambra Avenue. If a line were drawn in the same direction from the center of the Eastern Extension, it would cross the Los Angeles River about 600′ south of the Main-Street bridge. If a line were drawn S. 75° E. from the corner of Scott and Figueroa streets in the Central field, it would cross the Los Angeles River about half way between the Macy-Street bridge and the railroad bridge at Alhambra Avenue. The last-mentioned line would run a short distance north of the oil-seepages on the line of the Rapid Transit Railroad, and would strike the well drilled by Scott & Loftus on St. Louis Street, in which the oil-sand was struck at a depth of 560′. This line, if continued eastward, would strike the city limits about 600′ north of Wabash Avenue. If a line were drawn N. 85° W. along the strike of the formation, from the corner of Ocean View Avenue and Bonnie Brae Street, at

which point the oil-sand was struck at a depth of about 700′ below the city datum, it would pass about 1000′ south of the Baptist College. Assuming that along this line the oil-sand could be struck at a depth of about 700′ below the city datum, and that the angle at which the oil-sand dips at the Baptist College is 20°, the outcrop of the oil-sand would theoretically be at the Maltman oil-wells.

Investigations show that the dip of the exposed rocks in a creek immediately west of the Baptist College ranges from 20° to 25°, and that in some of the Maltman wells the oil-sand has been struck at a depth of less than 100′.

These facts were set forth by the writer in Bulletin No. 11 published in 1896, and in lectures given at a later date, and on maps showing the trend of the oil-yielding formations, which, as previously mentioned, were placed in the Chamber of Commerce and the Mining Exchange at Los Angeles, and in other public places.

How far subsequent events have proved the correctness of the deductions cited, is shown by the developments between the corner of Burlington Avenue and the portion of Ocean View Avenue, now called Miramar Street, and the Baptist College, as recorded in the following chapter.

CHAPTER 3.

THE LOS ANGELES OIL-FIELD, 1899, TO JULY, 1900.

3.3.1. In the autumn of 1899 prospecting was carried on along the strike of the formation from the corner of Quebec and Miramar streets, where the broken formation had been encountered. On Miramar Street, between Burlington Avenue and Alvarado Street, the oil-field was developed for a width of about 600′. The wells are owned principally by the Yukon Oil Company.

The formation at this point is somewhat different from that in the Central oil-field, and is as follows: Dark-colored shale to 300′; sand, with water and a little oil, 500′ to 800′; on the south side of the oil-line, shale to 1100′; oil-sand to 1200′. On the south side of the oil-line water was encountered below the depth of 1200′. About 100′, or less, of the oil-sand is impregnated with oil, but the lower portion of the sand is saturated with water. Farther northward, toward the center of the oil-line, the oil-sand is struck at 900′ and drilled through for about 300′. On the north side of the oil-line the oil-sand was struck at 700′ and drilled through to a depth of 1000′ without striking water; but in one well which was drilled to a depth of 1200′ water was encountered.

It is believed that the angle of the dip is about 45°. At the northern edge of the oil-line the two strata of oil-sand which have been followed in the Central oil-field appear to be squeezed together, forming one body of oil-sand, which has been penetrated for about 300′. The strata of oil-sand are interbedded with thin, irregular strata of clay.

It would seem that in the southern portion of the oil-line the water has, to some extent, displaced the oil and established a level for it about 1250′ below the surface of the ground.

At the corner of Alvarado and Ocean View avenues, the oil-sand was struck between 1180′ and 1250′, and was penetrated to a depth of 1300′, when a small amount of water was encountered.

The wells drilled in this area are quite productive. When first drilled, they started off at about 60 bbls. a day, but in one year the yield became reduced to 20 bbls. a day.

3.3.2. West of Alvarado Street the oil-line widens, probably owing to the lessening in the angle of the dip of the formation, and at Koefed Street it shows a width of about 500′. In this portion of the field it is rather deep drilling. Thus, in the Los Angeles Railway Company's wells, shale and sandstone were penetrated to a depth of about 1010′, at which depth the oil-sand was struck. This was found to be about 150′ thick.

In a well drilled by Mr. Kellerman near the south edge of the oil-line, the oil-sand was struck at 1250′, but at 1285′ a large volume of water was encountered. Mr. Kellerman says that west of Koefed Street the irregularity of the depth at which the oil-sand has been struck leads to the conclusion that there has been considerable geological disturbance.

In this portion of the field the wells vary from 1000′ to 1200′ in depth, and the oil-sand is thicker on the north side of the oil-line than it is on the south side. Near the southern edge of the oil-line there is trouble from water. In drilling there is also trouble from caving formation and the drill-holes have to be kept full of water. There are no productive wells south of Ocean View Avenue.

3.3.3. On Sixth Street, near Hoover, are the wells of the Uncle Sam Oil Company, Hardison, and others. The oil-line has been developed for a width of about 900′. At the south boundary of the oil-line the oil-sand was struck at a depth of about 525′, and found to be from 60′ to 90′ thick; on the north line it was struck at a depth of about 200′, and found to be about 23′ in thickness.

Near Hoover Street the oil-line widens to 1600′, owing probably to the lessening of the angle at which the formation dips. The depth at which the oil-sand was struck at the southern edge of the oil-line in this portion of the field is about 500′, and on the northern edge about 250′.

Immediately south of the Baptist College the oil-line may be said to extend from the Maltman wells, which are probably situated on the outcrop of the oil-sand, to Fifth Street, a distance of about 3000′.

The depth at which the oil-sand has been struck varies from about 300′ on the Maltman tract, which is now owned by the Los Angeles Oil and Transportation and Terminal Company, to about 1000′ in wells drilled by the Wilson Oil Company, on Miami Street, between Fifth and Sixth streets.

Between Hoover Street and Vermont Avenue the principal oil companies are the Wilson, the Green, the Westlake, the Wellington, and others. (See list of Los Angeles oil-wells.)

On the Maltman tract, and on Vermont Avenue, between First and Third streets, are the wells of the Los Angeles Oil and Transportation and Terminal Company. Here there are thirty-five wells from 300′ to 400′ deep. For the most part these are small producers, and the oil has a gravity of about 14.5° B. On the corner of First and Vermont streets a flow of warm water was struck at a depth of 800′.

3.3.4. West of Vermont Avenue are the oil-wells of the Hercules Oil Company, where the oil-sand was struck at a depth of between 300′ to 400′; and at the southeast corner of Vermont Avenue and Third Street are the wells of the Montana Oil Company, where the oil-sand was struck at a depth of about 400′, and the wells of J. Brown, in which the oil-sand was struck at a depth of about 400′.

In the wells of Brown and the Montana Oil Company, the oil has a gravity of about 17° B. Farther to the westward prospect wells have been drilled by the Hercules Oil Company, on Rosedale Avenue, between First and Fourth streets, where the oil-sand has been struck at a depth of about 300′. Similar results were obtained by the National Oil Company.

3.3.5. West of Western Avenue, two prospect wells were drilled by Mitchell, Stilson & Davis, near the corner of Western Avenue and Temple Street; they were abandoned. Subsequently these gentlemen drilled a well farther west, from which a large quantity of oil flowed.

South of the Wilshire Boulevard, wells were drilled by the following: Parker & Proudfoot, to a depth of 1040′; McGee, Tait & Johnson, to a depth of 1260′. The formation is shale. No oil was struck.

West of the boundary of the City of Los Angeles there has been considerable prospecting, the principal drilling being done by Thomas Brothers, who used a hydraulic rig, which drilled 4½″ test-holes. A rock-drill was used to penetrate the hard strata. Mr. Thomas states that on the Rosedale Cemetery tract he drilled six wells, 120′ to 800′ in depth, the formation being sand, hard blue clay and shale, and oil-sand. In one of the wells no oil-sand was struck, but gravel and water were encountered. The gravity of the oil is between 15° and 16° B.

About a quarter of a mile north of the Rosedale Cemetery tract are two wells drilled by Rommel. It is said that one of these wells is 1000′ in depth, and that 60′ of oil-sand was penetrated at the depth of 550′; the oil having a gravity of 18° B.

On the Croswell tract, about a quarter of a mile west of the Rosedale Cemetery tract, Mr. Thomas drilled two wells, one to a depth of 664′ and the other to a depth of 175′. The formation is as follows: Loam, 45′; oil-sand and gravel to 136′; blue clay to 200′; sand to 283′. At the last-mentioned depth a hard rock was struck.

About a quarter of a mile northeast of the Croswell tract, Mr. Thomas drilled a well for Garbutt & Pitcher. In this well the oil-sand was struck at a depth of 23′, and penetrated for about 96′; then clay, sand, and hard, thin strata were passed through to the bottom of the well, where more oil-sand was struck.

West of the Masslein tract, and immediately west of the well drilled for Garbutt & Pitcher, are three wells drilled for Messrs. Clark & Sherman of Los Angeles (Los Angeles Transportation Company). These wells are from 120′ to 521′ deep. In four of them the oil-sand was struck at a depth of 50′ to 85′. In another, which is 460′ deep, the oil was struck at 150′, and oil flowed from the casing. (See record of wells drilled west of the city limits of Los Angeles.)

In well No. 1 of the Pico Oil Company, the following formations were observed: Adobe, 20′; yellow clay to 60′; sand and gravel, with 4′ of oil-sand, to 129′; blue clay to 167′; sand rock and gravel to 450′; blue clay to 530′; black shale to 538′; blue clay to 545′; sand to 550′; blue shale, with traces of oil, to 558′; blue clay to 560′; black shale, with traces of oil, to 564′; blue clay to 566′; black shale to 572′; sand to 610′; blue clay, with traces of oil, to 620′; sand to 622′; blue clay to 635′; sand to 641′; blue clay, with oil, to 668′; blue shale, with oil, to 671′; blue clay, with oil, to 708′; shale, with black oil, to 780′; blue clay, with oil, to 822′. The oil at the bottom of the well was the best obtained.

A well drilled on the Abbott tract showed sand to 43′; gravel to 53′; rocks to 76′; sand and shells to 83′; rocks to 98′; blue sand to 118′; clay to 136′; sand and rocks to 142′; blue clay to 144′; sand and rocks to 167′; clay, rocks, and sand to 281′; blue clay to 347′; sand to 385′; blue clay to 390′; blue clay to 420′; sand to 595′; blue, sticky clay, with oil, to 598′; clay, blue clay, to 723′. More or less oil was observed in the formation between the depths of 598′ and 720′. The formation at the bottom of the well was blue clay.

In most of the wells south of the La Brea ranch much gas has been struck.

The cost of drilling with a hydraulic rig used by Thomas Brothers is: First 300′, 35 cents a foot; below that depth, 50 cents a foot; below a depth of 500′, 85 cents a foot. There is an extra expense when drilling in rock. The hydraulic rig can be used for drilling wells to a depth of 1000′. The hydraulic rig is of value to tell whether or not the formation contains an oil-sand, and the thickness of the oil-sand strata.

In the northern portion of the La Brea ranch, several prospect wells

PHOTO 9. PUENTE HILLS, FROM THE SOUTH FORK OF THE SAN GABRIEL VALLEY, LOS ANGELES COUNTY.

PHOTO 10. CLIFF OF SHALE, SAN PEDRO PENINSULA, LOS ANGELES COUNTY.

have been drilled by the Rhodes Oil Company, and in some of these strata of oil-sand have been penetrated which promise to be productive. (See record of prospect wells west of Los Angeles city limits, also Fig. A.)

The output of oil from the Los Angeles wells was:

During 1897	1,072,000 bbls.
During 1898	1,168,000 "
During 1899	1,032,036 "

These estimates are exclusive of the Maltman wells. (See record of Maltman wells.)

The output for 1897 was principally from the Central field; that for 1898 was about half from the Central field, and half from the Eastern Extension; that for 1899 was about 43% from the Central field, 30% from the Eastern Extension, and 27% from the Western Extension.

CHAPTER 4.

SAN PEDRO PENINSULA, LOS ANGELES COUNTY.

3.4.1. For several years some attention has been given to the possibility of there being oil-yielding formations on the peninsula of San Pedro. Hopes were encouraged by the discovery of a few springs of heavy oil and some outcropping ledges of oil-sand; and two prospect wells were sunk, only to be abandoned. In view of the fact that the harbor construction work, undertaken by the United States Government, would in the near future make San Pedro one of the principal ports of entry in California, the Mining Bureau was requested to examine the San Pedro Peninsula, with a view of ascertaining whether or not there was a reasonable probability of remunerative oil-yielding formations existing thereon. Hence, the work which is the subject of this report was undertaken.

3.4.2. The peninsula of San Pedro comprises an area of about 12 square miles. On the west it is bounded by the coast-line extending from Point Vincent to Point Fermin, and on the east by the coast-line between Point Fermin and the town of San Pedro. From the seashore the land rises toward the interior of the peninsula, showing a series of marine terraces and culminating in the summit of Mount San Pedro (i. e., San Pedro station), at an altitude of 1482′. (See Fig. E.)

3.4.3. Throughout the greater portion of the peninsula the exposed rocks consist of slates or. shales, traversed by numerous calcareous or silicious strata, and in places they are impregnated with heavy petroleum. These slates or shales are for the most part bleached to a whitish

or yellowish color, and form a great portion of the coast-line. (See Photo No. 10.) Near the town of San Pedro the whitish slate or shale gives place to a tough clayey formation, which is more or less bituminous in places.

In the upper portion of the whitish shale formation there are numerous strata of diatomaceous earth, and in some places the diatomaceous strata appear to rest non-conformably on the strata beneath them. The diatomaceous rocks can be well observed in the foothills west of the town of San Pedro (see Stations 11, 12, 13, 14, Fig. E); also along the northwest portion of the crest of the main ridge of San Pedro Mountain (see Station 50). At the extremity of the peninsula, i. e., at Point Fermin, there are bituminous sandstones. (See Photo No. 11.) At San Pedro the most recent of the rock formations is a series of soft sandstones, which rest non-conformably on the underlying formations. These soft sandstones are well exposed near the town of San Pedro, and on Dead Man's Island they contain numerous fossils of Quaternary age. All the aforementioned formations probably rest on metamorphic rocks (principally glaucophane and quartz schists), which are exposed in a cañon on the Rancho Los Palos Verdes (see Stations 44 and 45), or on eruptive rocks. In the southern portion of the peninsula the only traces of the metamorphic rocks are a few bowlders of glaucophane schist and some sandstone strata, which are practically made up of comminuted schist. Extending through the heart of the San Pedro Mountain is a mass of eruptive rocks, which may be observed at Stations 47 and 38, and at other places. At Station 37, on the coast-line west of Portuguese Bend, calcareous strata overlie eruptive rocks; at Station 40, on the north slope of San Pedro Mountain, the whitish shale is interstratified with eruptive rock; at Station 39 the whitish shale is penetrated by a dike, and at Long's Point sandstone and bleached shale are traversed by numerous small fissures filled with what appears to be decomposed eruptive rock. At the last-named point the sandstone contains numerous nodules of barite.

3.4.4. The topography of the peninsula of San Pedro shows a series of raised beaches, the flat tops of which furnish many excellent examples of marine denudation, modified by subaërial erosion. (See Photo No. 12.) The bituminous slates or shales are crumpled. (See Photo No. 35.)

3.4.5. In the territory under discussion, the geological disturbance has been so great that it would require a lengthy investigation to obtain the data requisite to form a map showing all the structural details, even if there were adequate rock-exposures. Moreover, the results would not contribute sufficient information on the question of petroleum deposits to warrant our department undertaking such a task.

3.4.6. At several points there are slight exudations of heavy bitumen from the bituminous shales; and on the shore-line, between Stations

PHOTO 11. Bituminous Sandstone, Point Fermin, San Pedro Peninsula, Los Angeles County.

PHOTO 12. Wave-Cut Terraces, San Pedro Peninsula, Los Angeles County.

3 and 4, there are two veins of asphaltum which show a thickness of from 2″ to 6″.

3.4.7. At San Pedro two wells have been drilled by prospectors for oil. One of these wells was drilled in 1895 by the San Pedro Oil Company. The record of this well shows: Adobe soil to 100′; dark-colored shale and brea to 400′; light-colored shale to 550′; brown shale to 850′. The water was cased off at 150′. It is said that small quantities of heavy oil were found beneath thin and hard strata. This well was abandoned on account of the loss of the tools, which became fast in the well. San Pedro Oil Company of Los Angeles is the owner.

Another well was drilled about 1 mile south of the center of the town of San Pedro, near the building known as the "Old Pierson Hotel." It is said that this well is 495′ deep, that the formation penetrated is nearly all clay, or clay-shale, with a little brea, and that a stratum of asphaltum was struck at the bottom of the well. It is also said that this well was abandoned on account of the death of the owner.

It is reported that rocks smelling of petroleum have been penetrated by many wells which have been sunk for water at San Pedro. Thus, in a well dug by A. Haller in the outskirts of San Pedro, the formation is: Black adobe soil to 3′; yellowish adobe to 12′; soft sandstone with sea-shells to 14′ (this stratum is nearly horizontal); whitish rock interstratified with brown rock to 22′; hard limestone to 24′; white clay (dipping south) to 26′; white, soft, probably diatomaceous, rock to 34′; black shale (dipping to the north) to 42′.

3.4.8. On the shore-line near the town of San Pedro, as previously mentioned, there are some formations of tough clay and clay-shales; these rocks are dark in color and somewhat bituminous. They bear a physical resemblance to certain oil-yielding shales in the Puente Hills, but the shales near San Pedro are so much disturbed that they fail to show the position of the dark-colored shales with regard to the bleached bituminous shales.

3.4.9. North of Resort Point on the Rancho Los Palos Verdes and along the shore-line toward Redondo, the only rock exposed consists of whitish shale and a soft sandstone which rests non-conformably on the shales. On the Palos Verdes ranch, near the seashore, a well was sunk to a depth of several hundred feet. The formation penetrated is a calcareo-silicious shale. It is said that a small amount of heavy oil was obtained. It was accompanied by much water.

3.4.10. From the foregoing it appears that although bituminous shales are exposed on the peninsula of San Pedro, with the exception of the bituminous sand at San Pedro no definite body of oil-sand was observed, and the shale is irregular and broken. The shale composing a great portion of the San Pedro Peninsula is the hard silicious shale which seldom contains valuable oil-yielding strata.

The rocks throughout portions of the San Pedro Peninsula show metamorphism, and are disturbed by the intrusion of igneous rocks. These features, together with the broken character of the formation in general, bespeak unfavorable conditions for the existence of valuable quantities of oil. This view of the case is strengthened by the fact that the only seepage of petroleum seen in the shale formation is of a very heavy kind, being practically asphaltum; and that the sandstone formation, which overlies the whitish shales at Point Fermin, is impregnated with petroleum. It is possible that if the bituminous sandstone exposed at Point Fermin could be struck at a depth of more than 500′, it might be found to yield oil in valuable quantities. Unfortunately, only a remnant of this sandstone is exposed, and the strike of the formation shows that its only extension lies beneath the ocean. North of township 5 south, the rocky formations are too much obscured by alluvium to admit of geological investigation.

CHAPTER 5.

THE SAN FERNANDO OR NEWHALL MINING DISTRICT.

3.5.1. The San Fernando petroleum mining district, commonly known as the Newhall district, is situated on the north slope of the San Fernando Mountains, about 25 miles northwest of Los Angeles. As far as the records show, this district is the oldest producing oil-field in California. During the year ending June 30, 1900, this district attracted much attention, and several new companies commenced operations therein. During 1899, however, practically the only company producing oil in this field was the Pacific Coast Oil Company, which has been a producing oil company for more than twenty years. The principal wells of this company are in Pico Cañon, about 6 miles southwest of Newhall (see Photo No. 29), in Elsmere Cañon, about 4 miles southeast of that town. The recent developments in the San Fernando district are hereinafter recorded in detail.

3.5.2. The character of the rocks exposed in this district leads to the conclusion that the principal oil-yielding formations are certain sandstones and shales which form the lower portion of the Middle Neocene formations, and some of the wells may penetrate sandstone of the Lower Neocene series.

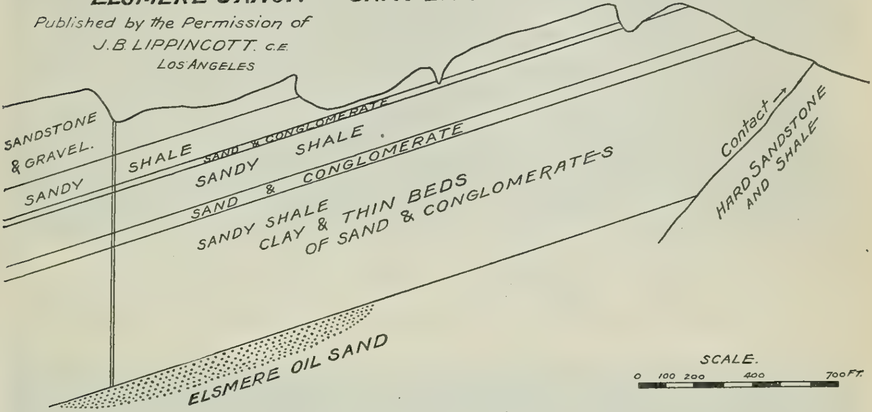
3.5.3. At a point in Elsmere Cañon, to which the writer's attention was directed by Mr. H. Hamlin of Los Angeles, sandstones containing fossils of the Middle Neocene epoch are found resting non-conformably

on hard sandstones resembling the Eocene sandstones of the Sespe district. The relation of these formations may be seen in Fig. 8.

3.5.4. One remarkable feature of the San Fernando district is that petroleum has been found in the crystalline rocks. The central mass of that portion of the San Fernando range which lies to the south of Placeritos Cañon is formed largely of crystalline rock, and, as hereinafter noted, in June, 1900, several companies were drilling in these crystalline rocks. It is an established fact that a small amount of oil

FIG. 8.

CROSS SECTION SHOWING NONCONFORMABILITY IN ELSMERE CAÑON - SANFERNANDO OIL DISTRICT.



has been obtained from crystalline rocks in the Placeritos Cañon at Newhall. The sample of this oil seen by the writer was of a very low specific gravity; it was quite transparent and of a light straw color. Since the writer visited the locality, wells have been drilled there which are said to be productive. It is stated that the formation penetrated is crystalline rocks overlying sedimentary strata.

CHAPTER 6.

TERRITORY BETWEEN NEWPORT, IN ORANGE COUNTY, AND THE SAN DIEGO COUNTY LINE.

3.6.1. In 1898 certain representative gentlemen of Orange County requested the California State Mining Bureau to examine the geological formations which form the coast-line between Newport and San Diego County and extend inland toward the Santa Ana Mountains, with a view of determining whether or not that portion of Orange County has

value as oil-territory. Since a cursory examination had shown that the geological formations in that area resemble those of the Puente Hills, and some prospects of oil were reported to have been discovered therein, the writer was detailed to make the examination which had been requested.

3.6.2. The territory examined comprises an area of about 300 square miles. It is traversed by two principal ridges of hills, which run in a northeasterly direction. One of these ridges extends along the coast from a point near the southeast corner of Orange County, marked Green Ridge in Fig. F, to San Joaquin Peak in the San Joaquin Hills, which peak rises to an elevation of 1185′. The other ridge extends in a northwest direction from Station 35 (marked in Fig. F as State Monument), about 5 miles from the coast-line, to and beyond Station 70. The ridge nearest the coast is cut through by the San Juan, Aliso, and Laguna creeks. The San Juan and Aliso creeks take their rise in the Santa Ana Mountains, and the Laguna Creek has its source in Laguna Lake on the San Joaquin ranch, and in sundry springs between Laguna Lake and the ocean. Thus, the territory referred to is in part hilly or mountainous, and in part mesa land. Its southern end is nearly all mountainous pasture; but toward the northwest there is a wide mesa devoted to agriculture. There is, also, some good agricultural and orchard land along the valleys of the San Juan and Aliso creeks.

3.6.3. The rocks forming the ridge nearest the coast are a conglomerate characterized by angular masses of glaucophane schist. In some places these masses look as if they were in place, but a close inspection shows that they are cemented to fragments of other rock. This conglomerate also contains numerous pebbles and angular fragments of white quartz. It is well exposed at San Juan Point, whence it can be traced in a northwesterly direction. It is said that the Sea Lion rocks, near San Mateo Point, are composed of a similar formation.

Resting with probable non-conformability on this conglomerate is a whitish sandstone resembling the whitish sandstone seen in Santiago Cañon, and containing fossils which are considered of Lower Neocene age by Dr. Merriam. This sandstone is exposed near the San Mateo and San Juan points (see Photo No. 13); it forms the great mass of the San Joaquin Hills, as is shown on Fig. F.

Resting on this sandstone is a widely extending formation of shale. In many places this shale has a purplish color, and some of it when heated gives out a faint odor of petroleum. The upper portion of this formation is interstratified with thin-bedded sandy strata; the shale passes into a tough clay, yellowish at the surface, but probably of bluish color at no great depth.

The central portion of this formation is tough shale. The lowest

PHOTO 13. Sandstone Formation on Shore-Line, Orange County.

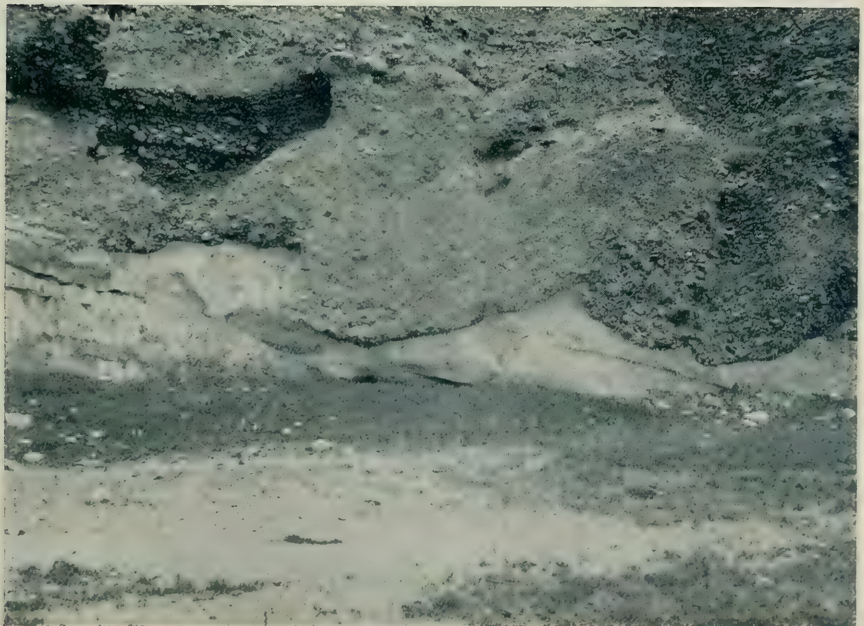


PHOTO 14. Conglomerate Resting Non-conformably on Sandstone, San Juan Capistrano, Orange County.

portions of the formation are white or whitish, and in some places resemble diatomaceous earth. These shales are similar in appearance to the Middle Neocene shales of the Puente Hills.

This shale formation extends inland toward the northernmost ridge of hills previously mentioned. For some distance inland, the prevailing dip is to the north at an angle of less than 20°. Still farther north the shales show an undulating structure, and, for the most part, dip at a very low angle. As the northernmost ridge of hills is approached, the prevailing dip is to the south, but it is irregular and greatly increases.

3.6.4. These shales overlie the sandstone on the north slope of the San Juan Hills and form the bedrock throughout a great portion of the mesa lands. They are exposed at many points along the Aliso Creek toward El Toro. In this direction there is an extensive deposit of white or light-brown shale, the lower portion of which is interstratified with yellowish sandstone, and in some places with ledges of limestone. Some of these limestone deposits are very extensive, and much limestone has been shipped therefrom. In some places the limestones contain large quantities of poorly preserved Neocene fossils. These shales also form a fringe of low cliffs along the coast-line between Laguna and the mouth of the Santa Ana River. The whitish shale underlies the shale described in the preceding paragraph.

3.6.5. On the west bank of the San Juan Creek, near its mouth, a conglomerate formation rests non-conformably on the eroded surfaces of the whitish sandstone. (See Photo No. 14.) It probably belongs to the same geological horizon as the formations observed at Stations 60, 41, 66, 7, and 65, where conglomerate and very soft sandstones are exposed. At Station 7 a tusk and part of the bones of a mastodon were found, and a small collection of fossils was obtained from a well dug in this formation. These fossils are of Upper Neocene (late Pliocene) age, corresponding to the Merced series. (See table of fossils No. IV.) A gray sandstone is exposed on Aliso Creek near El Toro, which belongs to this horizon.

It is probable that this formation is more extensive than is shown on Fig. F, but it can only be indicated where the exposed rocks show it to exist.

3.6.6. In the northern ridge of hills previously mentioned the same sequence of formation is met with as is seen along the coast-line, namely, conglomerate largely made up of fragments of glaucophane schist overlain by whitish sandstone and clay-shale. Along the north base of these hills there appears to be an extensive fault, for there is a sudden drop of about 500′, besides a sharply defined line between the conglomerate and the sandstone.

3.6.7. An inspection of the territory herein described leads to the conclusion that the shale overlaps the whitish sandstone, and for these

reasons: In most places the whitish sandstone is found resting on the glaucophane conglomerate, and the shale upon the sandstone, there being quite an interval of sandstone between the conglomerate and the shale. In other places, however, there is no sandstone exposed between the conglomerate and the shale. The alluvium obscures the point of contact between the conglomerate and the formation overlying it, but the short space between the exposed shale and the conglomerate is suggestive of an overlap. This opinion is strengthened by finding whitish shale resting on the conglomerate. Still, no very marked difference between the dip of the sandstone and the dip of the shale was observed.

3.6.8. The writer made a careful reconnaissance of the shore-line between Newport and Laguna, and of the north end of the San Joaquin Hills.

The greater part of this area is covered by mountains, which rise to a maximum height of 1185′. Toward the north the mountains slope down to the Santa Ana Valley, and toward the west to Newport Bay. At the north and west the mountains are bordered by marshes and peat lands of considerable extent. On the south, an ancient strand, now elevated 50′ or 100′ above the ocean, forms a narrow bench between the mountains and the seashore.

The mountains are, for the most part, formed of sandstone, and in a few places eruptive rocks are seen. The eruptive rocks are exposed at the northern end of the San Joaquin Hills, and at Abalone Point they are indicated on Fig. F by horizontal wavy lines.

For a distance of about 4 miles along the shore-line southeast of Newport Bay, the sandstone is bordered by shale, which, as before mentioned, corresponds to the shale formation in the Puente Hills. In some places this shale is highly silicified.

3.6.9. At Rocky Point these shales rest on hard sandstone impregnated with petroleum, and at several places in a distance of about half a mile along the shore-line north of Rocky Point, strata of oil-sand are exposed which are overlain by shale. The oil-sand and the shale are inclined at a great angle.

About one mile north of the town of Newport two formations are exposed. The lower of these consists of shales resembling the shale formation of the Puente Hills. The prevailing strike of these shales, as shown by the exposed rocks, is N. 50° W., and the angle of the dip ranges from 15° to 30°. A reconnaissance of this locality shows that the shale has been thrown into undulations producing a variable dip of comparatively low angle. At one point a stratum of dry oil-sand 2′ in thickness is interbedded with the shale, and in several places this shale is interstratified with thin strata of dry oil-sand a few inches in thickness. At several places the shale is traversed by fissures filled with dry oil-sand.

The uppermost formation consists of soft sandstone and yellowish clay-shale, some hard calcareous strata, and some which appear to be made up largely of diatomaceous material. Some of the strata contain Quaternary fossils. (See table of fossils No. V.)

The prevailing strike of this formation is east of north, and the angle of the dip ranges from 10° to 20°.

The lowest stratum of this formation is a soft sandstone impregnated with petroleum. The source of the petroleum appears to be the underlying shales.

3.6.10. From the foregoing it appears that the only portion of the territory investigated between Newport and the San Diego county-line, which would justify exploitation by the drill, is the territory around Newport Bay.

Since this territory was examined by the writer prospect wells have been drilled at Newport Bay by the Newport and the Santa Ana oil companies. (See Orange County—Prospect Wells.)

CHAPTER 7.

PROSPECT WELLS IN SAN DIEGO COUNTY.

3.7.1. *Monarch Oil Company* (of San Diego) has a well situated about half a mile east of False Bay, near San Diego. In October, 1900, this well was 800′ deep. Drilling.

3.7.2. *La Jolla Oil Company* has a well situated about midway between La Jolla and Pacific Beach, and about three-quarters of a mile from the ocean. In October, 1900, this well was 120′ deep. Drilling.

3.7.3. *San Diego Oil Company* has a well about one mile east of Encinitas, and in October, 1900, this well was about 400′ deep. Drilling.

3.7.4. *Carlsbad* (well near). The writer is informed that a company is drilling between Carlsbad and Oceanside.

PART 4.

PRODUCTIVE AND PROSPECT WELLS IN LOS ANGELES AND ORANGE COUNTIES.

CHAPTER 1.

PRODUCTIVE OIL-WELLS IN LOS ANGELES COUNTY.

4.1.1. The portions of Los Angeles County wherein productive oil-wells have been obtained are: the City of Los Angeles, that portion of the Puente Hills which lies west of Brea Cañon, and Newhall.

THE LOS ANGELES OIL-FIELD.

4.1.2. The Los Angeles oil-field may be said to be divided into three sections:

The Central (or old) field (see Photo No. 7), which extends from the corner of Victor and Temple streets to the corner of Bonnie Brae Street and Miramar Street, formerly called Ocean View Avenue;

The Eastern field (see Photos Nos. 6 and 8), which extends from the Sisters' Hospital to the Catholic Cemetery; and

The Western field, which extends in a westerly direction from the corner of Bonnie Brae and Miramar streets to the city limits.

These fields cover an area of rather more than 3 miles in length, and vary in width from about 500′ to more than 1000′. Within this area about 1200 wells have been drilled, and at the end of June, 1900, the number of producing wells was 663.

4.1.3. The productive wells were distributed as follows:

	Central Field.	Eastern Field.	Western Field.
Number of producing wells June 30, 1900	338	150	175
Product during 1899, in barrels	446,720	315,316	270,000

Total product of Los Angeles oil-field in 1899 was 1,032,036 bbls.

OIL-PRODUCERS IN LOS ANGELES CITY.

4.1.4. The following is a list of companies engaged in oil-mining in the City of Los Angeles in July, 1900, together with a statement of the number of productive wells:

	No. of Wells.
American Crude Oil Co.; Easton & Eldridge, 121 S. Broadway	14
Alderson, J. H.; 807 S. Hope Street	5
Acme Oil Co.; 405 and 407 N. Main Street	1
Alton, John; Farmers and Merchants Bank	5
Arizona Oil Co.; 227 Byrne Building	8
Alpha Oil Co.; 342 Byrne Building	7
Bayer & Roberts; 746 S. Broadway	4
Big "5" Oil Co.; care Columbia Savings Bank	3
Bernard, C. A.; cor. Alameda and Second streets	5
Burns, John; 932 Court Circle	2
Blunt, C. A.; 149 Kern Street	1
Berry Barton Oil Co.; 235 W. Third Street	1
Bobst, M.; 429 Victor Street	1
Brown, John; cor. Vermont Avenue and Third Street	2
Burlington Oil Co.; Doran & Brouse, cor. First Street and Belmont Avenue	15
Consolidated Oil Co.; Frost Building, room 610	38
Chase Nursery Co.; care Odonnell Oil Co., Hellman Block	3
Continental Oil Co.; Laughlin Building	8
Carr, Mrs. J.; cor. Lake Shore Avenue and First Street	1
Cates, A. M. (receiver); 310 Currier Block	2
Carter, H. V.; rooms 12–18, 254 S. Broadway	2
City Brick Co.; 125 E. Second Street	4
Crown Oil Co.; cor. Kern and Colton streets	5
City Water Co.; office, Los Angeles Street	2
Croswell Oil Co.; Edgeware Road and Omaha Street	4
Croswell, M. S.; Edgeware Road and Omaha Street	6
C. & H. Oil Co.; C. B. Boothe, 226 Los Angeles Street	3
Clampit, E. A.; 1442 Court Street	5
Connell, D. A.; cor. Ionia and Holliday streets	2
Cake, M. E.; cor. Grand Avenue and Seventh Street	4
College Oil Co.; 1633 W. First Street	5
California Crude Oil Co.; 419 and 420 Douglas Block	Drilling July 5, 1900
Doran & Brouse; cor. First Street and Belmont Avenue	6
Davis & Harrison; 815 Alpine Street	11
Daggett & Fletcher; 1342 Calumet Avenue	14
Davis, Cook & Co.; Alameda Street	1
Davis, Frank; 815 Alpine Street	4
Dryden, Wm.; 1071 W. Jefferson Street	2
Delta Oil Co.; McCarthy Bros., Henne Block	1
Enterprise Oil Co.; 135 W. First Street	1
Eagen, S.; care S. Clark, cor. Rockwood Avenue and Lake Shore	1
Easterday Bros.; cor. Temple Street and Boylston Avenue	3
East Side Oil Co.; care I. W. Stewart, Gardner & Zellner Block	2
Evans, T. H.; care Tubbs & Evans, New Depot Street	1
Evansville Oil Co.; cor. First Street and Union Avenue	1
Elton, C.; W. First Street	1
Fergusson, Mrs. M. L.; 649 S. Hope Street	1
Frazier, Mrs.; 123 E. Fourth Street	1
Ford, G.; 608 E. Fifth Street	2
Green & Whittier; 1633 W. First Street	4
Green, B. E.; 1633 W. First Street	2

	No. of Wells.
Green, R.; 1633 W. First Street	7
Gorham & Boeck; cor. Court and Tolucca streets	7
Graham Sisters; 131 N. Union Avenue	2
Green & Young; 1633 W. First Street	4
Giegrich, G.; 526 Bernardo Street	1
Green Mountain Oil Co.; Bartlett Music Co.	Drilling July 20, 1900
Headley, A. H.; cor. Bellevue and Ida streets	2
Huntley, E.; 1155 Temple Street	7
Harrison, H. H.; 821 Hinton Avenue	2
Hollingsworth, H. T.; 347 Wilcox Building	2
Hughes & Strasburg; 15 Baker Block	1
Hansen, C.; 815 N. Figueroa Street	2
Hammond, Mr.; 717 S. Union Avenue	1
Harris, R. T.; Santa Ana, Orange County	2
Hardison & H.; Ojai Building	8
Hervey, Mrs.; cor. Omaha Street and Edgeware Road	1
Hughes Bros. Oil Co.; 15 Baker Block	1
Hubbell Oil Co.; Bullard Block	2
Hall, Chas. Victor, Oil Co.; Wilcox Block	34
Joyce, T. F.; 971 Yale Street	7
Knight & Son; 315 Boylston Avenue	22
Korber, K.; 1320 Omaha Street	1
Kellerman, J. M.; Ocean View Avenue	1
Kellum, F. R.; 235 W. Third Street	1
Los Angeles Transfer Co.	1
Los Angeles Transfer and Terminal Co.; 222 W. Fourth Street	43
Lamb & Hanna; 504 Douglas Block	1
Los Angeles R. R. Co.; office, Central Avenue and Sixth Street	19
Lowry, W. P.; 985 Buena Vista Street	2
Lawrence, G.; 334 S. Main Street	1
Lamb, W. A.; 1929 Ocean View Avenue	2
Leslie & Spurling; W. P. Book, care Batcheler, Henne Block	2
Leslie, C. C. L.; 132 Quebec Street	1
Lake Shore Oil Co.; Laing & Wiggin	1
Longstreet & Carhart; 2403 S. Grand Avenue	3
Lewis, T. L.; Rockwood Street and Belmont Avenue	1
Los Angeles Oil and Trans. Co.; 201 Bradbury Building	5
Maier & Zobelein; Aliso Street Brewery	7
Martin, J. B.; 1447 Bush Street	3
McGarry, D. M.; 103 S. Broadway	1
Maunatt, I.	4
Magee, Mrs.; D. M. McDonald (Hellman Block)	1
Mattern, DeCamp & Co.; Frost Building	1
Montana Oil Co.; Bartlett & Jack, 360 S. Broadway	3
McDonald, Nance & Co.; Hellman Block	3
Mellen & Book; cor. Ocean View and San Joaquin Street	2
Nelson, R. T.; 2403 S. Grand Avenue	2
North, E.; 1726 W. First Street	4
Newman & Johnson; 109 S. Broadway	2
Oil Lake Fuel Co.; 601 Laughlin Building	1
Off Crude Oil Co.; 114 South Union Avenue	6
Odonnell Oil Co.; 225 Hellman Block	7
Odonnell, T. A.; 225 Hellman Block	1
Oceanic Oil Co.; Byrne Building	5
Parker Oil Co.; 224 Henne Block	47
Pennsylvania Oil Co.; 324–326 Laughlin Building	8
Phœnix Oil Co.; 717 S. Union Avenue	1
Parker & Morrill; care M. Morrill, cor. Court and Douglas and Thurston Well	8

	No. of Wells.
Puente Oil Co.; Room 14, Baker Block	3
Powell, J. J.; care Mr. Lloyd, New Wilson Block	2
Palm Oil Co.; Stimson Block, Rommel Oil Co.	4
Park Oil Co.; care Easton & Eldridge Co., S. Broadway	16
Pollard, John; 315 Boylston Avenue	1
Poindexter & Wadsworth; 305 W. Second Street, Frost Building	1
Robinson, Geo.; 232 W. First Street	1
Ruddy, Burns & M.; care C. H. Mathay, Alvarado and Ninth streets	1
Rommel Oil Co.; Stimson Block	3
Robinson, G. W., M. D. Oil Co.; care of Mr. Morrison, Metcalf & Temple	22
Reese, A. D.; corner College and Buena Vista streets	6
Rex Crude Oil Co.; Easton & Eldridge Co., S. Broadway	63
Schwarzendahl, L.; 1663 W. First Street	2
Sommers & McClannahan; 517 California Street	1
Skinner & Morgan; care Morgan-Perry Lumber Co.	3
Slocan, J. H.; care California Hardware Co.	1
Shirley, I. W.; Gardner & Zellner Block	12
Saunders, W. P.; 2315 S. Flower Street	2
Stratton & Tiedemann; Louis Supplee, Byrne Building	2
Sierra Oil Co.; 206 Douglas Block	7
Slocan Oil Co.; 14 Baker Block	11
Traction Co.; Traction Office	1
Tomlinson, Mrs.; 1316 Omaha Street	1
Tubbs & Evans; 1643 Central Avenue	4
Thompson, R.; 1320 Omaha Street	1
Uncle Sam Oil Co.; Hardisson & H., Ojai Building	11
United States Crude Oil Co.; C. J. George, 208 Laughlin Building	3
Victor Oil Co.; care Walter L. Young, 453 Cottage Home Street	1
Van Fossen & Cummings; D. C. McGarvin, 220½ S. Spring Street	2
Van Every & Co.; 109 S. Broadway	3
Van Trees, Mr.; 120 S. Witmer Street	2
Weller, Z. H.; 919 Kensington Road	8
Wing, K. W.; Belmont Avenue	2
West Lake Oil Co.; Clark & Bryan, Stimson Block	26
Wilson, W. D.; Hellman Block	15
Westlake, Walter; care 601 Laughlin Building	1
Wellington Oil Co.; 224 Henne Building	16
Whittier Consolidated Oil Co.; 225 Hellman Block	5
Young & Shaw; 453 Cottage Home Street	4
Young, Walter L.; 453 Cottage Home Street	1
Yukon Crude Oil Co.; Easton & Eldridge Co.	15

PRODUCTIVE WELLS WEST OF CITY LIMITS OF LOS ANGELES.

4.1.5. *Hercules Oil Company* (T. H. Dunham, president) has two 365′ wells on Rosedale Avenue, between First and Fourth streets. Oil-sand struck at 300′ and 311′ respectively.

4.1.6. *Los Angeles Oil and Transportation and Terminal Company* has seventeen wells, 300′ to 400′ deep, on Maltman tract, between First and Third streets, Vermont Avenue and Hoover Street. Average yield, 7 bbls. per day. Gravity of oil, 14.5° B. Formation penetrated: Yellow clay to 30′; dark brown sand to 70′; brown shale and sulphurous shale to 100′; then blue clay and shale to 250′; then oil-sand to 300′. Dip to

the southwest at an angle of about 20°. Five of these wells are within the city limits.

4.1.7. *San Gabriel Electric Light Company* has two wells 400′ deep on the northwest corner of Vermont Avenue and Fourth Street. Each well yields 12½ bbls. a day.

4.1.8. *Schmidt* (*Fred*) has three wells on the Luring tract, Third Street and Vermont Avenue. (See Transfer Oil Company.)

PRODUCTIVE OIL-WELLS IN THE PUENTE HILLS, LOS ANGELES COUNTY.

Only those wells are included in this list which were productive when the Puente Hills were visited by the writer in May, 1900. Unfinished wells are recorded under the head of "Prospect Wells."

4.1.9. The oil-fields in that portion of the Puente Hills which lies within Los Angeles County are the Whittier, the La Habra, and the Puente oil-fields.

The Whittier Oil-Field.

4.1.10. The Whittier oil-field represents that portion of the Puente Hills which extends from the San Gabriel River to the La Habra ranch. In May, 1900, the following companies were operating, or had drilled wells in the Whittier district:

4.1.11. *The Central Oil Company* (of Los Angeles). (See Photo No. 3.) The wells of this company are in Sec. 23, T. 2 S., R. 11 W., S. B. M., about a mile southeast of Whittier. In May, 1900, this company was pumping sixteen wells, 700′ to 1250′ in depth, producing 10 to 70 bbls. a day. Gravity of oil, 18° B. These wells supplied sufficient gas for fuel. All of the producing wells of the Central Oil Company are situated on the south limb of the fold marked BB in Fig. A. The formation penetrated by the wells of the Central Oil Company is represented by the following well-records:

Well No. 1 (completed December, 1897): Big flow of water at 275′; blue clay and oil-sand to 485′; 5 bbls. oil in 24 hours; stratified shale and sand, good showing of oil, at 730′; 10 bbls. oil; water; hard shell to 735′; blue clay, sand, and shale to 865′; thin shale, with good showing of oil of 21° B., at 865′; sand to 879′. Well drilled to 400′; oil-sand at 955′; well pumped 70 bbls. oil in 10 days; total thickness of sand penetrated, 90′. Well deepened to 894′; total thickness of sand penetrated, 105′; well pumped 60 bbls. oil in 10 days. In July, 1898, well pumped 25 bbls. oil a day.

Well No. 2 (550′ N. 20° W. of No. 1): Clay to 175′; big flow of water at 275′; stratified formation (caving) to 384′; good showing of light oil in sand at 650′; slate, with hard shell, at 890′; sand and shale to 910′; very light oil at 990′; good oil-sand at 1007′; hard shell to 1012′; thick slate to 1035′; sand and clay to 1070′; slate and shale to 1135′. Much gas. Well choked and filled up to 1070′. Well produces 8 bbls. oil of 26° B. a day.

Well No. 3 (completed July, 1898), about 325′ S. of No. 1: Clay and gravel to 340′; hard shell to 350′; broken shale, trace of oil, to 425′; fine, soft sand to 500′; brown sand to 640′; white shale, trace of oil, to 710′; white shale to 730′; soft, white sand to 780′; brown sand to 785′; blue sulphur and shale to 880′; oil and sand to 930′. Well filled to within 70′ of top. Well pumped 80 bbls. oil a day for two weeks. In July, 1899, 40 bbls. oil a day.

Well No. 5 (completed July, 1898): Blue sand to 100′; brown shale to 150′; sulphurous sand and water to 235′; brown sand to 310′; white shale to 375′; white sand, some oil, to 430′; white quicksand to 450′; blue quicksand to 490′; hard pebbles and sand to 520′; mud vein (2′) at 525′; fine sand to 545′; fine sand to 560′; blue shale to 575′; hard shell to 585′; soft, white slate to 620′; fine oil-sand to 685′.

Well No. 6: Water and gravel to 60′; white sand to 80′; blue slate to 250′; sand to 300′; hard shell to 308′; slaty blue shale to 325′; hard, blue shell to 335′; soft slate and sulphurous water to 400′; soft slate to 535′; oil-sand to 550′; slate to 565′; oil-sand to 790′; hard shale to 795′; sand to 840′.

The oil from these wells is conveyed by pipe-line to Los Nietos on the Santa Fé Railroad, a distance of about $4\frac{3}{4}$ miles.

4.1.12. *The Chandler Oil-Wells* are about 2 miles east of Whittier. In well No. 1, drilled in 1891, the formation is: Conglomerate to 200′; blue clay to 250′; fine sand and oil to 270′; blue clay and strata of sand and oil to 300′. Gravity of oil, 18° B. Well started at 3 bbls., and in 1897 was producing the same amount. No. 2 is 250′ south, 16′ east from No. 1, and at a lower elevation. Formation: Blue clay to 400′; hard stratum to 401′; sand and clay to 561′; sand contained oil and water.

4.1.13. *Clarendon Heights Oil Company* (of Whittier). The wells of this company are in Savage Cañon, about half a mile east of Whittier. In May, 1900, this company had two wells, 285′ and 336′ deep, respectively. These wells yield about 10 bbls. a day. Gravity of oil, 13° B.

4.1.14. *Fidelity Oil Company* (of Los Angeles). The wells of this company are about 1 mile northeast of Whittier. In May, 1900, this company had one productive well, and a second well was being drilled.

4.1.15. *Holden* (*T. D.*) (of Los Angeles) has a well one mile east of the Central Oil Company. Brea to 10′; conglomerate to 100′; sandy shale and thin strata of conglomerate to 900′; sandstone to 1000′; shale to 1050′; sulphur water at 800′. Abandoned.

4.1.16. *Home Oil Company* (of Los Angeles). The wells of this company are in Sec. 22, T. 2 S., R. 11 W., S. B. M., and are about three quarters of a mile northeast of Whittier. In May, 1900, this company had three productive wells and one dry-hole. The first well was drilled on the south side of Turnbull Cañon, about half a mile northeast of Whittier. The formation is: Well No. 1—Yellow sandstone to 100′;

soft shells with hard shells of blue sand-rock to 180′; black clay or clay-shale to 250′; tough clay, streaks of gray sand, to 360′; dark-gray sandstone to 400′; sandy clay-shale, streaks of gray sand, to 950′; water was struck at 105′, 250′, 400′, and 500′. Abandoned.

Subsequently this company drilled three other wells about one quarter of a mile east of their first well, with the following results: Second well, oil-sand to 400′; clay-shale to 550′; 3 bbls. Third well, oil-sand and shale to 960′; oil below 200′; 40 bbls. Fourth well, oil-sand and shale to 700′. Drilling in May, 1900.

4.1.17. *Turner Oil Company* (of Los Angeles). The territory of this company adjoins that of the Home Oil Company on the east. In May, 1900, this company had two productive wells, 1125′ and 550′ deep, respectively.

4.1.18. *Warner Oil Company* (of Whittier). The territory of this company adjoins that of the Central Oil Company on the west. In May, 1900, the Warner Oil Company had one well 1108′ deep, said to yield 48 bbls. a day. A second well was being drilled.

4.1.19. *Whittier Crude Oil Company* (of Whittier). The wells of this company are about 1 mile northeast of Whittier. In May, 1900, this company had two producing wells, one 1000′ and the other 1250′ deep.

The La Habra District.

4.1.20. This district lies between the Puente and Whittier oil-fields. The only company operating in the La Habra district is the Union Oil Company.

4.1.21. *Union Oil Company* (of Santa Paula, Ventura County) has two wells on La Habra ranch. One well is 1270′ deep, and produces about 3 bbls. of oil a day. In May, 1900, another well was being drilled, and was 1097′ deep. The formation penetrated by these wells is clay and sandy shale, with strata of oil-sand. Gravity of oil, 20° B.

The Puente District.

4.1.22. This district extends from La Brea Cañon to La Habra. The Puente wells, which have been successfully operated for more than a decade, are situated in the higher portion of the Puente Hills, about 2 miles west of Brea Cañon and 7 miles from Puente Station on the Southern Pacific Railroad.

4.1.23. *The Puente Oil Company* (of Los Angeles; J. A. Graves, president) has sixty producing wells, varying from 1000′ to more than 2000′ in depth, which yield from 5 to 40 bbls. of oil daily. The formation penetrated is shale, with strata of oil-sand, varying from 5′ to 20′ in thickness and yielding an oil of about 23° B., to a depth of about 1000′. Below this depth the oil-sand strata are thicker, and some of the deepest wells have passed through oil-sand for a distance of 100′ to 300′. The oil derived from these deeper formations has a gravity of from 30°

to 35° B. The oil from the Puente wells is conveyed by pipe-line to Chino refinery. (See chapter on Pipe-Lines and Refineries.)

PRODUCING WELLS IN SAN FERNANDO OR NEWHALL MINING DISTRICT.

Only such wells are mentioned as were producing oil in June, 1900.

4.1.24. *Kellerman and others* (of Los Angeles) have a well near the south line of Sec. 6, about 2 miles southeast of Newhall. This well is about 1400′ deep. The formation is mostly sandstone, with a little shale. The first oil was struck at 820′; gravity of oil, 25° B. A second stratum of oil was struck at 1140′; this oil had a gravity of 30° B. A third stratum was struck at 1450′; gravity, 35° B. It is said that this is a 10-bbl. well.

Pacific Coast Oil and California Star Oil Company (of San Francisco). The productive wells of this company are situated in the Pico, Elsmere, and Wiley cañons, and prospect wells are being drilled in Rice Cañon.

4.1.25. *Pacific Coast Oil Company's* wells in Pico Cañon are about 7 miles southwest of Newhall. (See Photo No. 29.) Here there are forty wells, varying in depth from 700′ to 1950′. The formation is sandstone and shale, the sandstone predominating. The gravity of the oil varies from 41° to 42° B. The oil is conveyed by pipe-line to Ventura, in Ventura County; distance 44 miles. (See chapter on Pipe-Lines, etc.)

4.1.26. *Pacific Coast Oil Company's* wells, in Elsmere Cañon. In this cañon there are fifteen wells, ranging from 400′ to 900′ in depth. Only seven of these wells are productive, and yield 7 to 45 bbls. a day; the formation being gravel, sandstone, and a little shale.

4.1.27. *Pacific Coast Oil Company's* wells in Wiley Cañon are about 3 miles southwest of Newhall. Here there are thirteen wells, ranging from 600′ to 1626′ in depth, but only three of these wells are productive. The formation is shale and sandstone, the shale predominating. Gravity of the oil, 30° B. The total product of the Pacific Coast Oil Company's wells is about 150,000 bbls. a year. The gravity of most of this oil ranges from 41° to 42° B.

4.1.28. *White Oil Company* (of Los Angeles; G. S. Deline, secretary) has a well 530′ deep, said to yield 25 bbls. a week; also a well 1030′ deep. These were the first wells drilled in the crystalline rocks. The outcropping rocks at the wells are crystalline schists, and in them a 30′ tunnel has been run for water, which yields enough for drilling. About 150′ down the hill from the tunnel is the 1030′ well previously referred to. The owners state that a hard crystalline rock was penetrated to a depth of about 50′. At that depth the rock became darker, and several seams of clayey material were passed through. Three of these seams were found to be oil-yielding. About 100′ north of the

1030′ well, a well has been drilled to a depth of about 500′. The officers of the company state that the formation in this well resembled that in the 1030′ well. They say that this well yields about 25 bbls. of oil a week. A sample of this oil was furnished the writer by Messrs. Freeman & Nelson. It showed a gravity of 37° B. This oil finds ready sale for medicinal purposes. North of the well the formation is crystallized limestone and gneiss.

CHAPTER 2.

PROSPECT AND UNFINISHED WELLS IN LOS ANGELES COUNTY.

Only those wells are mentioned which were drilled, or being drilled, in June, 1900.

PROSPECT WELLS WEST OF LOS ANGELES CITY LIMITS.

4.2.1. *Brea Ranch Well.* Formation, broken shale to 600′; at 900′ heavy oil flowed; mud to 1400′. J. E. Sanford, driller.

4.2.2. *Davis (C. B.)* has a well 400′ deep on Western Avenue, a short distance south of Mitchell & Stilson well. Formation, shale to 400′. Abandoned.

4.2.3. *Houser Tract Wells,* on Pico Street, 6 miles west of city. Well No. 1, sulphur water at 230′. Well No. 2, artesian water at 355′.

4.2.4. *Ivy Station Well,* 7 miles from Los Angeles, on S. P. R. R. to Santa Monica, on Washington Boulevard and road to Palms; 153′ deep; gas.

4.2.5. *John & Strong Well,* Eighth Street and Dewey Avenue; 850′ deep.

4.2.6. *Keating Wells.* No. 1 on Bonita Meadows ranch, between Adams Street and S. P. R. R. This well was drilled in 1898. The formation penetrated was adobe to 60′; black sand to 200′; quicksand to 250′; clay and sandstone to 450′; blue clay to 910′; sand and clay to 960′; hard sandstone to 1030′; clay to 1256′; traces of oil and gas at 1000′. No. 2, between Pico and Washington streets.

4.2.7. *Lewis Well* (Flora and Santa Monica Company), half a mile east of Cole Grove. Shale and sandstone to 400′; oil and sand to 412′; shale and sandstone to 600′; oil-sand to 620′; shale and sandstone to 800′. Two flows of artesian water were shut off in this well.

4.2.8. *Lombard & Lockhart* have three wells: No. 1, on ranch of C. Greve; 12 acres; 891′ deep; no oil. No. 2, on ranch of Joseph Whitworth; 14 acres; 417′ deep. No. 3, on ranch of Joseph Whitworth; 14 acres; at 417′ hard rock. Abandoned.

4.2.9. *Mansfield* (*Houser Station*) *Wells*, 7 miles west of Los Angeles. Well No. 1, 550′ deep; 60′ oil-sand at bottom. Well No. 2, old gas-well; burned many years in house. Well No. 3, 53′ deep, 31′ sand; gas in 1″ pipe, burning.

4.2.10. *Mitchell & Stilson* have a well 600′ deep on Western Avenue and Temple Street.

4.2.11. *New Mexico Development Company* has a well on the Arnaz ranch; down 600′; drilling.

4.2.12. *Pico Oil Company.* Well No. 1, on James Whitworth ranch, 7 miles west of Los Angeles. Formation: Adobe to 20′; yellow clay to 60′; sand and gravel with 4′ of oil-sand to 129′; blue clay to 167′; sand, rock, and gravel to 450′; blue clay to 530′; black shale to 538′; blue clay to 545′; sand to 550′; blue shale, traces of oil, to 558′; blue clay to 560′; black shale, traces of oil, to 564′; blue clay to 566′; black shale to 572′; sand to 610′; blue clay, traces of oil, to 620′; sand to 622′; blue clay to 635′; sand to 641′; blue clay, oil, to 668′; blue shale, oil, to 671′; blue clay, oil, to 708′; black shale, oil, to 780′; blue clay, oil, to 822′.

4.2.13. *Pitcher-Garbutt Oil Company* has two wells on Masselin ranch, 7 miles west of Los Angeles. Well No. 1, 901′ deep; oil-sand at 40′; pumped by hand. Well No. 2, 1073′ deep; standard rig; shale at 852′; oil-sand at 951′.

4.2.14. *Rhodes Wells.* No. 1, on Brea ranch, about 4 miles west of Los Angeles. Formation: Soil to 10′; yellow clay-shale to 73′; sand and bowlders to 85′; blue clay to 149′; shell to 154′; blue clay to 176′; shell to 177′; decomposed black shale to 192′; shell, or hard flinty blue shale, to 193′; oil-sand to 213′; gray shale to 214′; oil-sand to 237′; sand-rock to 239′; oil-sand to 282′; sand-rock to 284′; heaving beach sand to 324′; coarse black sand with asphaltum to 350′; hard rock to 351′; lightish-colored sand to 381′; hard oil-rock to 382′; oil-sand (showed well) to 432′; soft oil-rock of shale to 436′; coarse sand to 463′.

Well No. 2, on Brea ranch, about 800′ south of Rhodes Well No. 1. Formation: Soil to 10′; red sand to 50′; yellow clay and shale to 133′; shell to 137′; sand and bowlders (water strata) to 147′; blue shale to 185′; shell to 186′; shale to 215′; shell to 216′; clay to 255′; brea to 256′; shale to 284′; shell to 285′; shale to 302′; shell to 304′; shale and clay to 362′; shell or rock to 363′; shell to 370′; oil-sand (6′ shale about center) to 449′; rock to 452′; oil-sand to 484′; rock to 485′; sand to 527′; sand-rock to 535′; sand to 546′; shale to 548′; oil-sand to 596′; hard shale or rock to 600′. This well was drilled to a depth of 600′ by a hydraulic rig. Two days after removing the pipes the oil stood within 12′ of the surface. The gravity of the oil is 12° B.

Rhodes Well No. 3, on Brea ranch, about 800′ southeast of No. 1. Formation: Soil to 10′; yellow clay and shale to 74′; sand and bowlders (water strata) to 89′; shale to 104′; shell to 106′; blue clay to 173′; shell

to 179′; decomposed black shale to 211′; shell of hard blue shale to 212′; oil-sand to 245′; gray shale to 248′; oil-sand to 264′; hard shale or sand-rock to 265′; oil-sand to 267′. Casing would drive no further. Took out 20 bbls. twenty-four hours after cleaning well. Gravity of oil, 11° B.

4.2.15. *Rodeo Oil Company Wells.* No. 1, on Abbott ranch, west of Houser Station, 7 miles west of Los Angeles. Formation: Sand to 43′; gravel to 53′; gravel, with oil, to 76′; sand and shells to 83′; rocks to 98′; blue sand to 118′; clay to 136′; sand and rocks to 142′; blue clay to 144′; sand and rocks to 157′; clay to 160′; rocks and sand to 281′; blue clay to 347′; sand to 385′; clay blue to 390′; blue clay, traces of oil, to 420′; sand to 595′; blue sticky clay, oil, to 598′; heavy sticky blue clay to 723′; oil from 598′ to 723′; stopped in blue clay. Well No. 2 showed oil-sand at 400′.

4.2.16. *Rommel Company* has a well 750′ deep on the Gay tract. Oil from 75′ to bottom of well. Gravity, 25° B. Well flowed 10 bbls. per day while drilling. This company has also one well in Rimpau tract, east of Houser Station, about 6 miles west of Los Angeles. This well is 1000′ deep. It is said that a stratum of oil-sand 60′ thick was struck at a depth of 550′, and that it yielded an oil of 22° B.

4.2.17. *Rosedale Cemetery Wells,* 6 miles west of Los Angeles. On the cemetery grounds there are five wells. Well No. 1, 550′ deep; 60′ oil-sand, at bottom. Well No. 2, 800′ deep; water; no oil. Well No. 3, 160′ deep; 20′ oil-sand, at bottom. Well No. 4, 160′ deep; 30′ oil-sand, at bottom. Well No. 5, 120′ deep; 66′ oil-sand.

4.2.18. *Selby Oil Company* has a well on the southwest corner of Third and Rosedale streets, near Los Angeles; 400′ deep; clay-shale. Western Electric Works, 334 S. Main Street, drillers.

4.2.19. *Star Oil Company* has a well on the corner of Lee Street and Vermont Avenue, near Los Angeles; 1300′ deep; heavy oil.

4.2.20. *Thomas* (*H. C.*) has two wells on the Croswell tract, 6 miles west of Los Angeles. Well No. 1, 654′ deep; it is said that in this well oil-sand was struck from 45′ to 160′. Well No. 2, 175′ deep; it is said that in this well oil-sand was penetrated for 138′.

4.2.21. *Weid Well,* on Weid Estate, near Colegrove. Sand and gravel at 80′; blue shale at 800′; oil-sand, coarse; oil and water to 840′; water not cased off. Drilled by T. E. Sanford, 1013 Temple Street.

4.2.22. *Wicks and others* have a well 400′ deep on the Arnaz ranch, 7 miles southwest of Los Angeles. No. 1, 400′ deep. Little oil. Abandoned.

4.2.23. *Williams* (*C. H. L.*) (The National Oil Company) has a well on the southwest corner of First and Rosedale streets, near Los Angeles. Drilling.

PROSPECT WELLS—EAST LOS ANGELES.

Only such wells are mentioned as had been drilled, or were being drilled, in June, 1900.

4.2.24. *Bland* (*F. E.*), on Judson Street, between State and Lord streets. In a well drilled for water at this point, oil was struck at a depth of 80′.

4.2.25. *Far East Oil Company* has a well one third of a mile north of Evergreen Cemetery. Formation: Adobe to 500′; shale, dark shale, and clay to 540′; sand, with water and traces of oil, to 590′; shale (dark) to 630′; sand and water to 670′; blue shale to 930′.

4.2.26. *Headly Well*, north of Reservoir No. 5, East Los Angeles. Well, 840′; no oil.

4.2.27. *Johnson* (*Mrs. C. M.*), on State Street, corner Bailey. Well, 40′; oil.

4.2.28. *Rees Well*, near the corner of Britannia and Sheridan streets. Black mud, with occasional streaks of yellow clay, to 70′ (at this depth a thin stratum of water-bearing gravel was penetrated); shale to 85′; brea to 92′; shale, alternating in light and dark-brown color, to 400′; water-bearing sand to 403′; shale, impregnated with oil, to 800′; fine sand to 803′; blue shale to 525′. At this depth the casing had been reduced to 4″, and the well was abandoned.

4.2.29. *Scott & Loftus Wells*. No. 1, on St. Louis Street, between Emerson and Scott streets. Gravel to 45′; blue clay to 315′; sandy shale to 420′; water at 450′; tough clay to 475′; sandy shale and a little oil and gas to 555′; oil-sand to 560′; sandy shale to 800′; sand and water to 875′. Seven barrels a day, 17° B.

No. 2, 400′ east of Soto Street, on Magnolia Avenue. Gravel to 20′; blue clay to 625′; sulphur water and blue clay to 650′; sandy shale to 800′; sand and water to 803′. No oil.

4.2.30. *Whiting* (*Dwight*) *and others* have a well about 250′ east of the intersection of the El Monte wagon road and the San Gabriel branch of the S. P. R. R., about 4 miles east of Los Angeles. Formation, shale and sandstones. In May, 1900, this well was 500′ deep. A thin stratum of oil-sand was passed through at a depth of 300′.

4.2.31. *Wilkinson* (*J. M.*) has a well one fourth of a mile east of Reservoir No. 5. Well, 670′. Said to have shown traces of oil at 640′. Yellow shale to 25′; blue shale to 175′; blue shale and hard shells to 365′; blue clay-shale to 410′; gray shale to 500′; blue mud and strata of shale and a little oil to 640′.

PROSPECT AND UNFINISHED WELLS IN THE PUENTE HILLS.

Only those wells are mentioned which were drilled, or being drilled, in May, 1900.

4.2.32. *Chino Well No. 1* was drilled by the Chino Valley Beet Sugar Company of Chino in 1897. It is on the Chino ranch and near the southeast corner of Sec. 35, T. 2 S., R. 9 W., S. B. M. This well is 1000′ deep. The formation is sandstone, with a few thin strata of shale. No oil was struck, and well is abandoned. There is an exposure of oil-sand in a ravine about a quarter of a mile west of this well.

4.2.33. *Chino Well No. 2* was drilled in 1897–98 by the Chino Valley Beet Sugar Company near Station 100 in Sec. 3, T. 2 S., R. 8 W., S. B. M. The formation penetrated is: Red clay and sandy shale to 70′; white sand with water to 77′; shale to 240′; white sand and water to 248′; dark shale to 272′; gray sand, water, and much gas to 310′; light-colored shale to 410′; dark shale to 440′; oil-sand to 465′ (at this depth a small amount of heavy oil was struck); dark-colored shale to 475′; sand and water to 500′; clay-shale to 590′; coarse sand to 600′; fine sand to 610′; coarse sand to 620′; fine gray sand to 630′; gray sand to 640′; coarse sand to 650′; fine sand with water to 670′; brown shale to 675′; and shale with thin strata of sandstone, all smelling of petroleum, to 1000′. Abandoned.

4.2.34. *Gird Well*, on Chino ranch near the south line of T. 2 S., R. 8 W., S. B. M.; drilled in 1890. This well is near a seepage of heavy oil at a point on the Chino ranch marked Station 40 on Fig. A. Near the well a stratum of oil-sand is exposed. For the following record of the well referred to the writer is indebted to the courtesy of Mr. J. Kellerman, well-driller: Soft brown shale to 120′; white sand with water to 185′; rotten shale with water to 400′; soft sand to 450′; sand and shale to 950′; sand with brackish water to 1020′; sand and shale to 1200′. This well was abandoned on account of the water. The water was accompanied by a small amount of oil.

4.2.35. *Gird Well*, near quarry of bituminous sand. Several years ago a well was drilled about half a mile northeast of the Gird quarry of bituminous sand near where the Brea Cañon road crosses the east line of T. 2 S., R. 9 W., S. B. M. It is said that this well is 800′ deep and that two or more strata of oil-sand were penetrated which yielded some heavy oil, but that the oil was cased off and the well deepened in order to obtain water from strata underlying the oil-sand.

4.2.36. *Joyce Oil Company* (of Whittier) has a well in Savage Cañon west of the Clarendon Heights well. In May, 1900, the Joyce well was unfinished.

4.2.37. *Murphy Oil Company* (of Los Angeles). In 1897 this company drilled a well about 1 mile southeast of Whittier. The formation penetrated is as follows: Soft yellow sandstone to 35′; sandstone and

tough blue clay to 40′; tough blue clay to 476′; limestone stratum to 481′; quicksand and showing of oil to 487′; sandy shale to 527′. Abandoned. In 1898 the Murphy Oil Company drilled two wells about 100 yards southeast of the Chandler wells. In the first of these wells conglomerate was penetrated to a depth of 660′. Mr. Plotts, superintendent, states that it yielded about 6 bbls. of heavy oil a day. In the other wells conglomerate was passed through for 850′ and then soft shale to a depth of 1760′. No oil was found in this well, and the locality was abandoned. In May, 1900, this company was drilling a well a few hundred feet south of the wells of the Central Oil Company.

4.2.38. *North Whittier Oil Company* (of Los Angeles). In May, 1900, this company commenced drilling on the spur of hills between Turnbull and Sycamore cañons, at a point northwest of the wells of the Home Oil Company and about 1 mile north of Whittier.

4.2.39. *Shirley & McGray* (of Los Angeles) have a well in Savage Cañon and west of the Clarendon Heights well. In May, 1900, the Shirley & McGray well was 700′ deep. The formation penetrated is conglomerate.

4.2.40. *Whittier Oil Company* (of Whittier). In 1897 this company drilled two wells in the mouth of Savage Cañon, about half a mile southeast of Whittier. The formation is: Well No. 1—Soil and gravel to 70′; sand-rock and conglomerate to 300′; oil-sand and conglomerate to 400′; sandy shale to 660′. Abandoned. Well No. 2 (about 350′ south of first well)—Soil to 10′; yellow sand-rock to 20′; conglomerate to 110′; water at 170′; sandy shale to 1100′. Abandoned.

PROSPECT AND UNFINISHED WELLS IN NEWHALL DISTRICT.

Only those wells are mentioned which were drilled, or being drilled, in June, 1900.

4.2.41. *Alpine Oil Company* (of Los Angeles; R. R. McKinney, president) has two wells situated in the S.E. ¼ of Sec. 12, T. 3 N., R. 16 W., S. B. M. One of these wells is 760′ in depth. The formation penetrated is sandstone, with thin strata of shale. Oil-sand was struck at the bottom of the well. In driving the casing, water broke in and drowned out the well. When this property was visited a second well was being drilled, and a depth of 750′ had been reached.

4.2.42. *Bervelle & Bradshaw* (of Los Angeles) have a well situated in East Cañon, the south branch of Rice Cañon. Well said to be 400′ deep. No oil; much water.

4.2.43. *California Oil Company* (of Los Angeles; J. R. Thomas, president) has a well in the N.W. ¼ of Sec. 17. Formation said to be granite.

4.2.44. *Commercial Oil Development Company* (of Los Angeles; Robert McGarvin, president). This company is drilling in the N.E. ¼ of Sec. 13, about 2½ miles south of Newhall.

4.2.45. *Eureka Crude Oil Company* (of Los Angeles; J. H. Hellman, president) has a well in S. ½ of Sec. 13, T. 3 N., R. 16 W., S. B. M. This well was being drilled in June, 1900.

4.2.46. *Good Luck Oil Company* (of Los Angeles; W. W. Lowe, president) has a well in the S.E. cor. of Sec. 7, T. 3 N., R. 15 W., S. B. M. The manager stated that the following formation was penetrated: Decomposed granite to 30′; quartzose rock to 58′; blue clay to 65′; gravel to 69′; blue clay to 72′; granite and blue clay to 670′; granite and blue clay, containing traces of oil, to 675′.

4.2.47. *Iola Oil Company* (of Los Angeles; R. H. Knight, president) has a well in the E. ½ of Sec. 12, T. 3 N., R. 15 W., S. B. M., and at the time the locality was visited had been drilled to a depth of 200′. Formation said to be granite rock.

4.2.48. *New Century Oil Company* (of Los Angeles; C. W. Smith, president). When the territory was visited, this company was about to drill in the N.E. ¼ of the S.E. ¼ of Sec. 4, T. 3 N., R. 15 W., S. B. M. Formation, granitic rock.

4.2.49. *Pioneer White Oil Company* (of Los Angeles; G. W. Freeman, president) has a well in the S.E. ½ of Sec. 3, T. 3 N., R. 15 W. At the time the locality was visited this well had been drilled to a depth of 100′. Formation, granitic rock.

4.2.50. *Rice Cañon Wells* (owned by the Pacific Coast Oil Company of San Francisco) are about 3 miles southwest of Newhall. In this cañon the Pacific Coast Oil Company has drilled two wells in the N.W. cor. of Sec. 22. These wells range from 500′ to 800′ in depth. The 500′ well is a 3-bbl. well, but in the 800′ well the water could not be shut off.

4.2.51. *Rice* (*W. P.*) has a well situated on his property in Rice Cañon. In this well sandstone and shale were penetrated to a depth of 550′, when oil-sand was struck which yielded 3 bbls. of oil a day. The well was then deepened to a depth of 700′, when water was encountered.

4.2.52. *Towsley Cañon Wells.* The Graves Oil Company and others have drilled, all told, three wells in this cañon; considerable oil was struck, but the wells were abandoned on account of water.

4.2.53. *Yankee Doodle Oil Company* (of Los Angeles; H. C. Dillon, president) has a well in the N.E. cor. of Sec. 7. When visited, this well had been drilled to a depth of 200′.

4.2.54. *Zenith Oil Company* (of Los Angeles; F. A. Garbutt, president) is drilling on land of H. C. Needham, about 1¾ miles southeast of Newhall.

MISCELLANEOUS PROSPECT WELLS IN LOS ANGELES COUNTY.

Only such wells are mentioned as had been drilled, or were being drilled, in June, 1900.

4.2.55. *Arctic Oil Company* (of San Francisco) has three wells on the ranch of R. Garvey, Rapetto Hills; drilled 1897–98. One well 600′

deep, one well 1200′ deep, and one well 1100′ deep. Abandoned. Drilled by Kellerman.

4.2.56. *Bell Station Well*, at Terminal Railroad, Los Angeles County. Soil and sandy loam to 600′; gravel and water to 580′; bed of shells to 920′; gravel and water to 980′; bed of sea-shells to 1320′. At the bottom of the well the formation was gravel and sand with water. George Catey, well-driller, Los Angeles.

4.2.57. *Bluett & Mullen* (of Los Angeles) have two wells in Palomaras mining district, Castac Cañon, about 10 miles northwest of Newhall. This well is in the S.W. ¼ of Sec. 18, T. 5 N., R. 16 W., S. B. M. Formation as follows: Drift to 80′; soft sandstone to 30′; shale and sandstone to 300′; dark shale to 350′; shale and sandstone to 500′; hard shell and gray sandstone to 512′; soft, dark shale to 600′. Water was not shut off, but traces of oil were brought up by the sand-pump. Gas was struck at 500′; it burned with a flame 15′ above a 5⅝″ casing. About 10′ north of this well, a well had been previously drilled. The formation was the same as in the first recorded well to a depth of 550′. Below that depth gray and white sandstone was drilled through to a depth of 940′.

4.2.58. *Castac Oil Company* (of Los Angeles) has one 800′ well in Palomaras district, Castac Cañon, about 12 miles northwest of Newhall, which was drilled without casing. Formation, shale and sandstone. At 600′ dry asphaltum was penetrated for 20′. Abandoned.

4.2.59. *Climax Oil Company* has a well on the road to Verdugo, 1½ miles north of Garvanza, 160′ deep. Formation, sandstone. In July, 1900, this well was unfinished.

4.2.60. *Hellman Ranch Well*, about 9 miles east of Los Angeles. Formation, clay and discolored water to 140′; quartz rock to 142′ (gold bearing?). Drilled by Palmer, Los Angeles.

4.2.61. *Pacoima Oil Company* (of Los Angeles) has a well in Sec. 20, T. 3 N., R. 14 W., S. B. M., about 4½ miles north of San Fernando, Los Angeles County. Well, 800′ deep. Drilling.

4.2.62. *Rosecrans Wells.* C. E. Rosecrans has kindly given the following information concerning the wells on the Rosecrans tract, in Secs. 18 and 19, T. 3 S., R. 13 W., S. B. M., and other wells in the vicinity:

Gas wells: Well No. 1 was sunk fourteen years ago for water. Formation: Soil, sand, gravel, etc., to 100′ (water at 40′); shale to 115′ (water under the shale); black sand to 135′. Gas under high pressure was struck beneath the shale, and the water standing 40′ below the top of the casing was constantly agitated. The gas continues to force its way through 60′ of water, with a pressure roughly estimated at 35 pounds. This gas is used for lighting and cooking in a house on the Rosecrans tract. Well No. 2, a short distance northwest of No. 1, is 90′ deep; formation, similar to that of No. 1. From this well, in which the shale was not fully penetrated, a small amount of gas has escaped for more

than nine years. Well No. 3, about 300′ northwest of No. 2, had a little gas in it, but it is now filled up.

Ten years ago, about 1½ miles southeast of the Rosecrans wells, on the Duncan property, in the Hayward tract, a well was drilled for artesian water, to a depth of 400′. Gas collects in this well. Brea is found in the vicinity of this well and has been used by the owner for fuel for many years.

In 1899, about half a mile west of the Rosecrans gas wells, in Sec. 18, a 4″ hole was drilled for artesian water. Formation: Soil, clay, sand, and gravel to 180′; sand-rock or shale to 195′. Owing to an accident this well was abandoned and a new well drilled 15′ away. A formation similar to that of the abandoned well was passed through to 330′, but the drill used was not strong enough to penetrate the strata below that depth. In this well below 180′ the formation seemed dry, hard, and clayey, and the shale oily. At about 197′ there was a showing of carbonaceous matter.

Recently a test well for oil was commenced in Sec. 19, about 700′ southwest of the gas wells. In this well gas was struck at about 95′ and at about 145′. At 250′ an oil-sand stratum 10′ thick was struck. At about 420′ a few feet of grayish oil-sand was encountered, and the driller stated that when drilling below this depth he saw traces of oil on the drill. At a depth of from 110′ to 220′ an abundant supply of water, which rose to within 40′ of the top of the casing, was struck.

On the Rosecrans ranch, in Sec. 23, there is an oil seepage from an irrigation well. This well is 380′ deep.

4.2.63. *Schuyler Ranch Well*, 2 miles southwest of San Dimas; 300′ deep. It is said that a small amount of oil was struck in this well. Abandoned.

4.2.64. *Sickleworth Ranch Well*, 1 mile north of Puente; 800′ deep. Formation: Tough clay; strata of sand and gravel with water at the following depths: 120′, 400′, 650′, 720′. Water stands at 54′. George Catey of Los Angeles, driller.

4.2.65. *Wells near Azusa.* Two prospect wells have been drilled. It is said that traces of oil were obtained.

OTHER PROSPECT WELLS IN LOS ANGELES CITY.

4.2.66. *Bartelow Well*, on Moulton tract, corner of East Main and Daly streets, East Los Angeles; 300′ deep; no oil. Abandoned.

4.2.67. *Chandler Wells*, northeast corner of Macy and Center streets; 775′ deep; formation, principally shale; 1½ bbls. of oil; much water. Abandoned.

4.2.68. *Maier & Zobelein Brewing Company's Well*, on Aliso near Amelia Street; 10″ pipe. Formation: Sand and gravel to 23′; wash to 76′; red sand and bituminous shale to 98′; bituminous shale to 678′; hard, silicious rock to 684′; water flowed at 825′; shale, with thin strata of limestone, 16″ to 16′ thick, to 1266′; 8″ pipe; sand and gravel to

1366′; water forced sand into pipe; yellowish gravel to 1432′; blue clay to 1454′; white gravel to 1458′; sand and shells, principally sand, to 1600′. Abandoned.

4.2.69. *Moulton Well*, on Moulton tract, corner of East Main and Daly streets; 887′ deep; formation said to be sandstone (granite and quartz). Much gas; no oil. Abandoned.

CHAPTER 3.

PRODUCTIVE OIL-WELLS IN ORANGE COUNTY.

Only those wells are classed as productive which were so in May, 1900.

4.3.1. The portion of Orange County wherein productive oil-wells have been obtained is commonly known as the Fullerton oil-field. This oil-field comprises an area on the south slope of the Puente Hills, between Brea and Soquel cañons. In May, 1900, the following oil companies were operating in this district:

4.3.2. *Brea Cañon Oil Company* (of Los Angeles; D. Murphy, president). (See Photo No. 4.) The territory of this company is situated near the mouth of Brea Cañon. When this territory was visited by the writer there was one producing well, which had proved very remunerative. It was drilled in 1899, and it is said to have yielded several hundred barrels a day during the first six months. Two other wells were being drilled. The formation is soft, sandy shale, containing much oil. A very fine-grained material, somewhat resembling quicksand, forces itself into the casing with the oil. The formation penetrated by the Brea Cañon Oil Company's wells dips to the south.

4.3.3. *Columbia Oil Company* (of Los Angeles). The territory of this company is in Sec. 5, T. 3 S., R. 9 W., S. B. M. This company has four wells; depth, 775′ to 950′; yield, 6 to 100 bbls. a day. The life of these wells may be gathered from the following data: Well No. 1, when completed in May, 1899, yielded 25 bbls. a day; in May, 1900, it yielded 6 bbls. Well No. 4, when completed in February, 1899, yielded 150 bbls. a day; in May, 1900, it yielded 100 bbls. These wells adjoin the wells of the Santa Fé Railroad Company on the east. The formation penetrated resembles that noted in the wells of the Santa Fé Railroad Company.

4.3.4. *Consolidated Olinda Oil Company* has two wells in the Fullerton district. No. 1, 1000′ deep, is a 10-bbl. well. No. 2, 1300′ deep; drilling. Formation, sandstone and shale, the latter predominating.

4.3.5. *Fullerton Consolidated Oil Company* (of Los Angeles; C. V. Hall, president). The wells of this company are in Sec. 8, T. 3 S., R. 9 W., S. B. M. Here there are two producing wells. Gravity of oil, 18° B. The formation penetrated by these wells is shown by the follow-

ing records: Well No. 1: Conglomerate to 40′; clay-shale and sand to 820′ (at this depth a stratum of oil-sand a few feet in thickness was struck); clay-shale, sandy strata, and oil-sand to 165′. Well No. 2: Conglomerate to 325′; below that depth a similar formation was penetrated to that noted in well No. 1.

4.3.6. *Fullerton Oil Company*, formerly Rex (of Los Angeles; J. T. Fay, president), has five wells in Sec. 9, T. 3 S., R. 9 W., S. B. M. These wells range from 400′ to 1000′ in depth. At the time these wells were visited only one well was producing. One of these wells was used for water-supply; in one the tools had been lost and it was abandoned, and the others were in process of drilling.

4.3.7. *Graham & Loftus* (of Fullerton). The wells of this company are in the N.W. ¼ of Sections 8 and 9, T. 3 S., R. 9 W., S. B. M. In May, 1900, they had five wells 600′ to 1875′ deep. The production of these wells ranges from 6 to 122 bbls. daily; gravity of oil, 21° B. Some idea as to the life of these wells may be gathered from the following facts: One well, which yielded 25 bbls. a day when completed, ten months later yielded only 6 bbls. a day. Another well when completed yielded 200 bbls. a day; after ten days it yielded only 125 bbls. Another, which was drilled to a depth of 1465′, when completed yielded 500 bbls. the first day and 700 bbls. the second day; the yield then decreased, and after twelve months it yielded only 60 bbls. a day. The character of the formation penetrated by these wells is shown by the following well-records: Well No. 2: Yellow clay to 50′; blue clay and oil-sand to 150′; oil-sand and sandy shale to 240′; clay-shale to 300′; oil-sand to 730′; sandy shale to 965′; oil-sand with gas to 1005′; sandy shale and oil-sand to 1090′; oil-sand and shale to 1400′; oil-sand penetrated to 1465′. Well No. 3: Yellow clay to 50′; clay-shale to 300′; sandy shale to 360′; conglomerate and shale to 550′; clay-shale to 920′; sandy shale to 1130′; sandy shale and oil-sand to 1250′; oil-sand to 1370′; sandy shale and oil-sand to 1500′; oil-sand to 1565′; sandy shale and oil-sand to 1790′; oil-sand to 1875′. Mr. Loftus states that his wells are located within a few hundred feet of one another. They show a great variation in yield. He attributes this to the size of the grains forming the oil-sand. He says the fine oil-sand is the most productive.

4.3.8. *The Santa Fé Railroad Company* has nineteen wells in the Fullerton oil-field. (See Photo No. 5.) These wells range from 670′ to 1700′ in depth, and produce from 7 to 100 bbls. a day; black oil, gravity 20° B. The general character of the formation penetrated by these wells is: Conglomerate about 20′; blue clay and shale; between the depths of 400′ and 850′ the shale was interstratified with oil-sand. Below this depth the underlying formation consists of strata of shale interbedded with thin strata of limestone and oil-sand. In one well, about 2000′ southeast of the main group of wells, conglomerate was penetrated for 200′; then shale with strata of oil-sand to a depth of 1800′.

The oil from this well is of a dark-green color and shows a gravity of about 30° B. This well yields more gas than do the other wells belonging to this company. The Santa Fé wells yield enough gas to fire the steam boilers and for domestic use. The strata penetrated by the wells dip to the north, but the drilling records show that there is a great irregularity in the angle of the dip.

4.3.9. *Union Oil Company* (of Santa Paula, Ventura County) owns a large tract of land near the mouth of Brea Cañon, and in May, 1900, had drilled three wells to a depth of 200′, and the casing was full of oil; gravity of oil, 21° B. The formation penetrated appears to be a soft, sandy shale.

The Fullerton oil-field is the only producing oil-field in Orange County, and in 1899 it produced 108,077 bbls. of oil. In May, 1900, the oil from the greater portion of the Fullerton oil-field was conveyed by tank cars on a spur of the Santa Fé Railroad. The Union Oil Company had just completed a pipe-line which extends from the Fullerton oil-field to Bixby; distance, 26 miles. This is a 4″ pipe-line, and has a head of 450′. The gravity of the oil which will be run through this line averages 21° B.

CHAPTER 4.

PROSPECT WELLS IN ORANGE COUNTY.

Only such wells are mentioned as had been drilled, or were being drilled, when Orange County was visited by the writer in May, 1900.

4.4.1. *Egan Ranch Wells*, near Capistrano, in S.E. $\frac{1}{4}$ of N.W. $\frac{1}{4}$ of Sec. 36, T. 7 S., R. 8 W., S. B. M. Formation of Well No. 1: Gravel to 26′; clay to 34′; gravel and bowlders to 55′; conglomerate "cement" to 67′; sand and bowlders to 102′; black shale, with a little gas and oil, to 315′. Well No. 2 (about 1000′ northeast of No. 1): Gravel to 26′; clay to 30′; gravel and bowlders to 58′; conglomerate to 65′; black shale to 253′.

4.4.2. *Jenson Ranch Well*, near Wanda railroad station; 130′ deep. At 80′ stiff blue clay formation was struck; gas, water, traces of oil.

4.4.3. *Marius Meyer* (of Fullerton) has a well $1\frac{1}{2}$ miles north of Santa Fé Springs. The formation is gravel and pebbles to 80′; clay and sand to 310′. When completed this well threw a column of gas and water and stones to the height of 300′ above the casing.

4.4.4. *Newport Oil Company's Wells* are on the shore of Newport Bay, about 1 mile north of Newport. The records of these wells are:

Well No. 1: Sand, black and white, to 50′; brownish shale to 120′; brownish clay-shale, spotted with asphaltum, to 180′; liquid asphaltum to 230′; shale, fine and coarse sand, asphaltum, to 245′; coarse, granitic white sand, to 260′; blackish shale, globules of oil, to 300′; blackish

shale, little asphaltum and oil globules, to 375′; alternate streaks of shale and dark sand to 495′; white, coarse sand, to 585′; alternate strata of shale and sand, sulphureted water, to 700′; cemented sand and gravel to 702′; white sand and salty water, quicksand and gravel, to 775′.

Well No. 2: Soil to 8′; coarse yellow sand to 60′; dark shale to 220′; hard shell to 240′; black shale and sulphur water to 280′; black shale to 300′ (seepage of asphaltum); black shale to 400′; hard shell to 402′; hard shell with asphaltum to 460′; black shale to 520′; black shale to 740′; sand and salt water to 765′.

Well No. 3: Surface soil to 16′; white rock to 45′; soft shale and sulphur water to 140′; soft shale and water to 350′; soft black shale to 505′; hard black shale to 610′; hard stratum of white shale to 617′; hard black shale, salt water, to 770′; hard white rock to 773′; hard black shale to 800′; hard shale to 830′; soft blue shale to 885′.

4.4.5. *Orange County Oil Company* (of Santa Ana; W. A. Becket, president). This company is operating on the north side of Santiago Cañon, about 5 miles east of Olive, and in May, 1900, had drilled to a depth of about 500′ and found traces of oil.

4.4.6. *Puente Crude Oil Company* (of Los Angeles; E. Kendall, secretary). In May, 1900, this company was drilling a well on the east side of the Spadra road, near Brea Cañon. When this locality was visited this well had been drilled to a depth of 500′. The formation penetrated was shale and slate.

4.4.7. *San Joaquin Ranch.* Lot 284: Well drilled in 1894 by W. Manser of San Bernardino County. Formation: Soil and clay to 150′; clay to 246′; gravel and sand to 247′; yellow and red clay to 269′; black sandstone to 303′; black and white rock to 304′; blue slate to 308′; hard blue slate to 309′; blue slate, very hard, to 314′; cemented rock to 484′.

Lot 323: Well drilled in 1894 by W. Manser. Formation: Clay to 62′; gravel and water to 66′; soft clay to 102′; hard clay to 116′; clay to 124′; gravel and water to 134′; hard clay to 150′; gravel to 160′ (sand and water); clay to 214′; gravel and water to 220′; clay to 234′; gravel and water to 236′; clay to 254′; hard clay to 322′; sandy clay to 340′; gravel to 342′; clay to 350′; sand, gravel, and water to 360′ (water rose to within 23′ of top of casing); hard clay to 402′; gravel to 404′; hard clay to 416′; soft clay to 512′; hard clay to 540′; soft mud to 556′; gravel and clay to 566′; hard clay to 638′; gravel, sand, and clay to 646′; clay to 660′; sand to 672′; clay to 676′; sand with gravel to 686′; clay to 719′.

4.4.8. *Santa Ana Oil Company* has a well 1400′ deep, on east side of Newport Bay.

4.4.9. *Soquel Oil Company* has a well on the N.W. ¼ of Sec. 10, southeast of the Sante Fé Railroad Company's wells. The rocks penetrated evidently belong to the whitish sandstone formation and dip to the south. Drilling.

PHOTO 15. Concretion from Whitish Sandstone Formation, Piru, Ventura County.

PHOTO 16. Broken Concretion from Whitish Sandstone Formation, Piru, Ventura County.

PART 5.

VENTURA COUNTY.

CHAPTER 1.

THE TERRITORY BETWEEN SESPE AND PIRU CREEKS.

5.1.1. The geological work done in Ventura County by the writer during the last campaign of the Mining Bureau consists of an examination of the formations overlying the oil-measures developed by the Union Oil Company in the Sespe district; and of an examination of certain oil-yielding rocks of Eocene age, which are referred to in Bulletin No. 11 as the lowermost oil-yielding rocks in that district. (See Fig. G.)

5.1.2. The field-work recorded in this chapter was undertaken in order to examine the formations overlying the oil-yielding rocks of the Sespe district, and to examine recent developments in the lowermost oil-yielding rocks of that district.*

5.1.3. As described in Bulletin No. 11, oil-measures of distinctively Eocene age underlie the Sespe brownstone formation, and consist of certain whitish and brownish sandstones and dark-colored shales. (See Photo No. 27.) The oil-yielding rocks exploited by the Union Oil Company in the Sespe district consist of sandstones and certain dark-colored shales which overlie the Sespe brownstone formation, and which represent the upper portion of the Eocene formation.

5.1.4. The investigation of the formations overlying the oil-yielding rocks of the Sespe district involved an examination of the territory lying between the Sespe and Piru creeks. The territory under consideration extends south and east of the Sespe district; and it is, for the most part, quite mountainous, many of the higher elevations rising to an altitude of from 2000′ to more than 3000′, and furnishing only roughest pasture. (See Photos Nos. 19, 20, 21, 22.) The mountains are traversed by numerous cañons, the principal ones being Piru Cañon, Hopper Cañon, and Pole Creek Cañon. In a general way these cañons run at an angle to the strike of the formation. (See Fig. G.)

*The greater portion of the territory in which these lowermost oil-yielding rocks are exposed is now included in a new district called the Devil's Gate oil-district.

5.1.5. Overlying the dark-colored shales of the Sespe district is a formation consisting of whitish sandstone, with some shale and conglomerate. This sandstone resembles the whitish sandstone found in the Puente Hills and at Santiago Cañon; at the latter place it contains Miocene fossils. These sandstones are characterized by calcareous concretions (see Photos Nos. 15, 16, and 23); they contain a few Miocene fossils, and in some places they are impregnated with petroleum. As shown in Fig. G, this whitish sandstone occupies a large area in the higher mountains between the Sespe and Piru creeks. It belongs doubtless to the Lower Neocene division of the Tertiary system in California.

5.1.6. The whitish sandstone is overlain by a shale formation which is very silicious and in most instances shows a calcareous reaction. (See Photo No. 17.)

The silicious character of these shales is very apparent where the erosion has been rapid, or where the slides have exposed cliffs of freshly broken strata. Where the erosion has been gradual, the shale decomposes and loses its cherty appearance, and, to a casual observer, resembles the clay-shales in the upper portion of this formation. Above the cherty shales there is a thick stratum of sandstone. (See cross-sections at Hopper Creek, Figs. 9 and 10.) Above this stratum of sandstone, the shale varies from sandy to clayey, and for the most part is either reddish or brownish in color. (See Photo No. 18.) In some places these shales exhibit a slaty cleavage, and apparently have been bleached by the action of sulphureted vapor. The physical appearance and geologic age of the clay-shales correspond to that of the clay-shale formations seen in the Puente Hills and at Los Angeles. As hereinafter described, the lower portion of this shale formation is interbedded with sandstone, which is frequently impregnated with petroleum. The writer obtained a small collection of fossils from the clay-shales which are sufficient to identify the formation as of Middle Neocene age. It is probable that the cherty shales, like the whitish sandstones which underlie them, represent the Lower Neocene in the territory under consideration.

The shale of Middle Neocene age forms the greater portion of the foothills between the Sespe and Piru creeks, and a large portion of the mountains east of Piru Creek is composed of shale and sandstone belonging to this formation.

As is elsewhere mentioned, there is reason to believe that these shales overlap the whitish sandstone formation. West of the Castac Creek, shales and sandstone, resembling in physical appearance the Neocene formations, rest on granitic rocks; and in San Francisco Cañon similar looking shales and sandstones, which contain fossils representing the Middle Neocene epoch, rest on metamorphosed sedimentary rocks.

Extending from the Tar Creek Divide almost to Piru Creek, there is a body of shale resembling the Neocene shale, and resting on the dark-

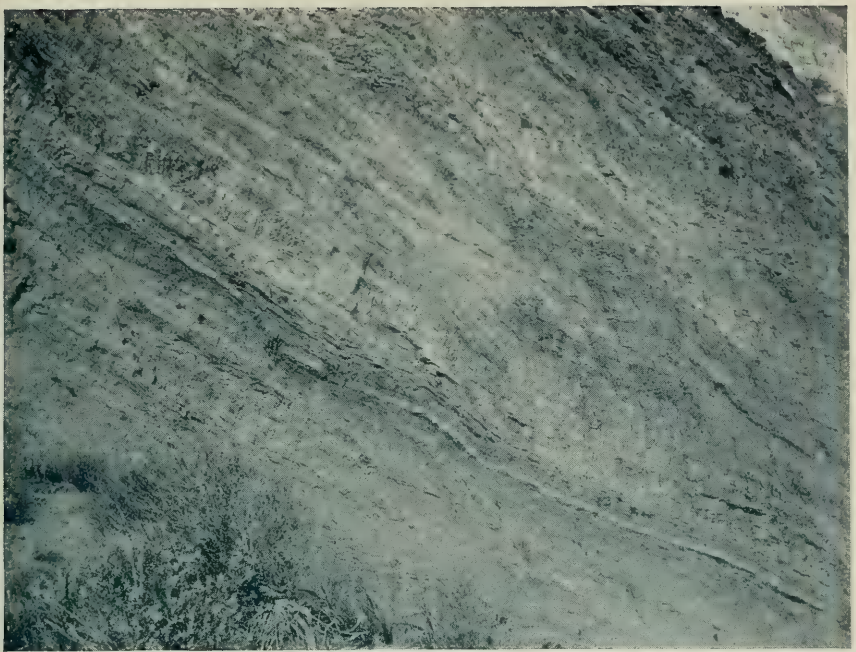


PHOTO 17. Silicious Shales, Hopper Cañon, Ventura County.

PHOTO 18. Clay-Shales, Hopper Cañon, Ventura County.

colored shales of the Sespe district. It would require a closer examination than it was practicable to give in the time at the disposal of the writer, in order to determine whether this body of shale is part of the Sespe formation or belongs to the Middle Neocene series. The writer could find no fossils in it, and, physically, it resembles the last-mentioned formation.

5.1.7. In the lowest tier of foothills between the Sespe and Piru creeks, a conglomerate formation is exposed. This conglomerate overlies the shale formation. Between the Sespe Creek and the village of Piru it may be observed only in a few places, but at Piru it forms a bluff of considerable altitude. In the foothills east of Piru Creek this conglomerate is the prevailing formation, and in some places is found resting on the shales of the Middle Neocene series. The writer obtained a small collection of fossils from this conglomerate, and Dr. Merriam refers them to the Middle Neocene epoch.

5.1.8. As stated in Bulletin No. 11, the whitish sandstone, the shale, and conglomerate formations, compose the foothills at the base of Mount Cayetana, which rises to the westward of the Arroyo Sespe, and resting on the conglomerate are sandy formations and some clay-shales containing numerous distinctively Pliocene fossils, clearly representing the Upper Neocene formation.

5.1.9. It is somewhat difficult to outline the contact between the whitish sandstone and the Middle Neocene shales, partly on account of the complexity of the geological structure, and partly because throughout a large area the upper portions of the ridges are composed of shale, while the ravines cut through into the sandstone, forming an area between the whitish sandstones and the Neocene shales in which both the sandstone and the shale formations are represented. (See Photo No. 21.)

5.1.10. Between the Sespe and Piru creeks there appear to be two systems of folds: dominant folds having a strike of east of south, such as the fold marked DD (see Fig. G), and minor folds, which have a strike east of north, the latter folds being the more numerous. These folds are described in detailed accounts given of the Piru and Hopper cañons, but the time at the disposal of the writer did not admit of their being traced through their entire length.

Between the Piru and Hopper cañons the geological structure is complicated by fault-lines extending, for the most part, in the direction of the strike of the formation. The complex folding and the fault-lines have broken up the strata into blocks, which have subsequently been tilted, causing a diversity of strike at variance with the strike of the original folds. The effect of these fault-lines will be spoken of later on. In some places it is evident that the rocks are deeply fissured, although no evidence of displacement can be observed. At some of these

points sulphureted vapors have decomposed and bleached the rocks and formed deposits of sulphur. (See Photo No. 19.) This solfataric action is similar to that observed in the Puente Hills near Whittier, and at the Sulphur Mountains in Ventura County. The last-mentioned locality was described in our Bulletin No. 11.

At the point marked "Sulphur Mine" in Fig. G, about 3 miles east of Fillmore, a company exploited one of these deposits with a view of obtaining sulphur for commercial purposes. After removing the surface of decomposed and bleached rock, which was more or less impregnated with sulphur, a very thin stratum containing about 30% of sulphur was found. At a depth of 3′ the rock was too hot to be safely handled with the bare hand.

5.1.11. As previously mentioned, there are numerous evidences of petroleum in the formations overlying the Eocene rocks. In some places, notably west of Piru Creek, there are places where the whitish sandstones are more or less impregnated with petroleum, forming a dry oil-sand; and the oil-yielding strata at the Modelo and Sunset oil-wells are composed of sandstones which may be classed as belonging to this series of rocks. At the Fortuna and Piru oil-wells, the oil-yielding strata may be referred to the lower portion of the Neocene shale formation. Sandstones belonging to this series and highly impregnated with petroleum, are exposed on the Piru ranch, in Hopper and Pole cañons, and at many other places. At one point on the Piru ranch the conglomerate is impregnated with petroleum.

5.1.12. The Hopper Cañon was selected as a suitable locality at which to investigate the rocks overlying the Sespe formation, for, throughout a great portion of its course, it cuts through these rocks in a direction which is nearly at right angles to their strike. Moreover, there are two groups of producing wells in this cañon, and prospect work has resulted in trails being cut which facilitate geological research.

5.1.13. The formation and structure observed between the mouth of Hopper Cañon and the Fortuna oil-wells, are shown in Fig. 9. The first bench of the foothills to the east of Hopper Cañon is formed of conglomerate, and the dip of the strata is a little east of south at an angle of about 60°. This conglomerate rests on the Neocene shales, which are much disturbed, and which dip both east of south and west of south. The shale rests on sandstone, and this rests on hard silicious shale. At Station 132 (see Fig. 9) there is an anticlinal axis. This is the axis of fold marked BB in Fig. G. On the northern limb of this fold the silicious shale shows a thickness of more than 1500′ and is capped with sandstone. There is evidently a fault along the axis of BB, for an air-saddle drawn from the contact of the shale and sandstone on the north side of the fold would not connect with the point of contact between the shale and sandstone on the south side of the fold.

PHOTO 19. Rocks Bleached by Gas Outburst in Clay-Shale Formation, East of Fillmore, Ventura County.

PHOTO 20. Piru Peak, from Piru Cañon, Ventura County.

FIG. 9

CROSS SECTION BETWEEN STA. 200. N.E. OF BUCKHORN R.R. DEPOT, & STA. 201 NEAR BRADLEY & HUTTON'S WELL IN HOPPER CAÑON.

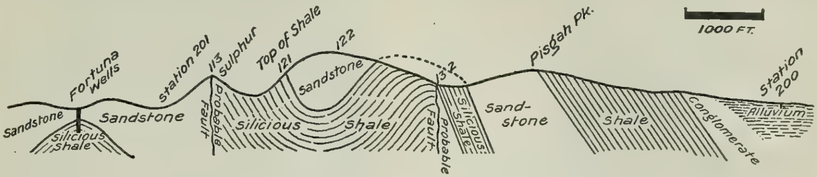


FIG. 10.

CROSS SECTION

BETWEEN HUTTON PEAK & HOPPER CAÑON

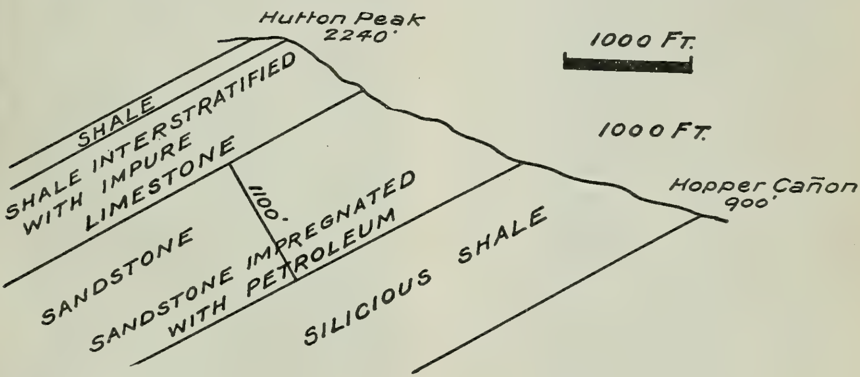
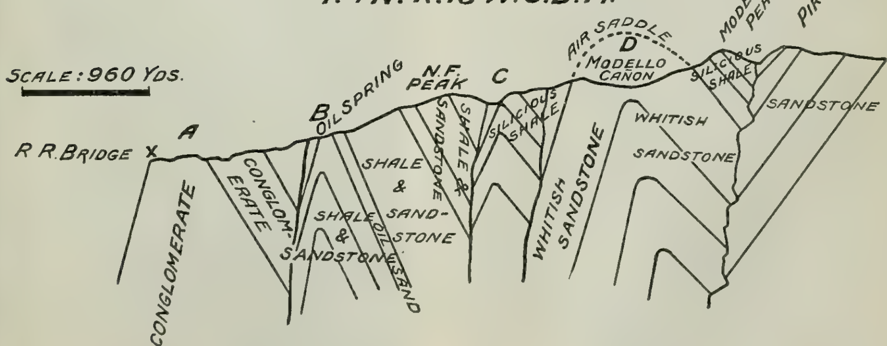


FIG. 11

CROSS SECTION RUNNING N. 10 W. FROM THE R.R. BRIDGE AT PIRU TO N. PIRU PEAK
T. 4 N. R. 18 W. S. B. M.



Station 122 is on a ridge which rises to an elevation of more than 188′. This ridge is capped with sandstone, which lies on the silicious shale formation in the syncline between fold BB and a short fold marked EE in Fig. G, which latter fold lies farther to the north. Between Stations 121 and 113 the formation is silicious shale, which, in this locality, constitutes the south limb of fold EE, the dip being east of south at an angle of about 55°. At Station 113, the axis of fold EE is exposed. There is probably a fault at this point, for the rocks are decomposed by sulphureted vapor and impregnated with bituminous matter and sulphur; on the north limb of this fold the formation is sandstone. Farther to the north, another short fold is shown, marked FF. This fold has a more northerly course than folds EE and BB. Both limbs of fold FF are formed of sandstone, but it is said that in the Fortuna oil-wells, which are situated on this fold, a silicious shale resembling that shown on folds BB and EE has been penetrated for several hundred feet.

The formations immediately overlying the silicious shale may be observed at Hutton Peak, on the west side of Hopper Cañon, where an escarpment rises to an altitude of more than 2200′. (See Fig. 10.)

5.1.14. A cross-section, giving a view of the formations exposed at this point, is shown in Fig. 10. At Hutton Peak, clay-shale interstratified with impure limestone shows a thickness of 990′, and dips to the west of north at an angle of about 40°. This shale rests on a light-colored sandstone about 1100′ in thickness. The lowermost strata of this body of sandstone are more or less impregnated with petroleum. This sandstone rests on silicious shale. There is no doubt that the sandstone shown in Fig. 10 corresponds to the sandstone seen at the Fortuna wells. The formation shown in Fig. 10 corresponds to the formations underlying the conglomerate between Stations 200 and 132, Fig. 9; but in Fig. 10 the entire thickness of the clay-shale does not appear, for there is a large body of shale occupying a syncline between Hutton Peak and the point marked "Minarets" on Fig. G.

5.1.15. When this locality was visited by the writer, Messrs. Bradley & Hutton were drilling a well in the silicious shale near the axis of fold EE. Several years ago a well was drilled in Hopper Cañon near the axis of fold BB. It is said that there was a showing of oil all the way down to a depth of about 700′, but a remunerative quantity of oil was not obtained.

5.1.16. Investigations in the vicinity of Piru and Hopper cañons lead to the conclusion that the silicious shale shown in Fig. 9 constitutes either the lowermost portion of the Neocene shales previously mentioned or the uppermost portion of the Lower Neocene formation. A comparison of the silicious shales seen at the Modelo oil-wells with those in Hopper Cañon warrants the conclusion that both are of the same geological horizon. The writer has dwelt somewhat at length on these silicious

PHOTO 21. View Looking West from Modelo Peak, Ventura County, Showing Relation of Neocene Shales to Whitish Sandstone Formation.

PHOTO 22. View Looking Northwest from Piru Peak, Ventura County, Showing Relation of Neocene Shales to Whitish Sandstone Formation.

shales because they constitute a landmark in the Neocene formations of the locality under discussion, and probably correspond to the whitish shales noted in other localities.

5.1.17. Between Hopper Cañon and Piru Creek, the whitish sandstone, the shale, and the conglomerate formations are well exposed. (See Photos Nos. 21 and 22.) On San Felician Creek, near the southeast corner of the Piru ranch, a few fossils were obtained from the shales, and are referred by Dr. Merriam to the Middle Neocene epoch. (See table of fossils.) East of Piru Creek, the conglomerate forms the greater portion of the foothills. These conglomerates contain Neocene fossils, in which Pliocene forms preponderate. The pebbles forming the conglomerate are principally granitic, and contain much black mica. As a general rule, the pebbles are not very firmly cemented together.

5.1.18. At Piru Creek, and throughout the territory adjacent thereto, the writer traced the aforementioned formations. The whitish sandstone is exposed in Packard Cañon, and although it is in many places covered up with the shale overlying it, yet it can be traced westward to the main body of whitish sandstone which lies between Piru Creek and the Sespe district.

East of Piru Creek, a sandstone formation may be followed for half a mile or more. West of Piru Creek the same formation is exposed along the upper portion of Modelo Cañon, and extends thence to Hopper Cañon. There are several other points at which a whitish sandstone is exposed by faults in the formation, or by the erosion of the overlying shales. In many instances it is difficult to determine whether to regard the exposed sandstone as belonging to the whitish sandstone of the Lower Neocene, or as strata of sandstone belonging to the lower portion of the Middle Neocene, the only difference being that the Lower Neocene sandstone is harder than that of the Upper Neocene formation.

5.1.19. The typical shales of the Middle Neocene formation extend about half a mile east of Piru Creek, and northward up Piru Creek to a point about a mile north of Holser Cañon. These shales are exposed about a quarter of a mile south of Holser Cañon, and extend about half a mile farther southward. On the west side of Piru Creek the Middle Neocene shales and sandstone form the lower portion of the mountain slope between Packard and Modelo cañons; south of Modelo Cañon they constitute the prevailing formation between Piru and Hopper cañons, and west of Piru Peak they may be seen resting on the whitish sandstone formation. (See Photo No. 22.) As previously mentioned, the sandstone in the lower portion of the Middle Neocene formation is in some places more or less impregnated with petroleum. On the accompanying sketch-map of the territory between Piru and Hopper cañons, such oil-sands are marked by three stars, and oil-springs by one star. (See Fig. G.)

5.1.20. The conglomerate overlying the Neocene shales extends over a large area south and east of Piru Creek; and constitutes, for the most part, the lower foothills on the north side of the valley of the Santa Clara River between Piru and Hopper cañons.

5.1.21. The geological structure of the territory under discussion is that of closely compressed anticlinal folds, which are so modified by faulting that in some instances it would seem more appropriate to describe them as faults rather than folds; but since they are lines of disturbance along which an anticlinal structure prevails, they are herein treated as separate folds. As shown in Fig. 11, which represents a cross-section through the mountains between the railroad bridge at Piru and Piru Peak, there are four short but distinct folds in a distance of less than three miles. These folds are marked on Fig. G as AA, BB, CC, and DD, respectively.

5.1.22. The general course of folds AA, BB, and CC is about N. 75° E., while that of DD appears to be west of north. Folds AA, BB, and CC appear to be cross-folds to fold DD. The position of these folds may be noted by referring to Fig. G.

5.1.23. An inspection of Fig. 11 shows that folds AA, BB, CC, and DD are inclined folds, although fold CC shows little inclination, owing to faults at or near its axis. The general inclination of the axis of these folds is toward the south at an angle of about 10° from the vertical.

5.1.24. An investigation of these folds shows that their structure becomes very irregular as Piru Creek is approached. Some idea of this irregularity may be gathered from a short description of the lines of disturbance represented by folds AA, BB, CC, and DD.

5.1.25. Fold AA was observed only at Station 3 near the railroad bridge at Piru. If the axis of this fold were prolonged to the west, it would pass out into the valley of the Santa Clara River at Piru; if prolonged to the east, it would pass into the hills east of Piru Creek.

5.1.26. Fold BB, as observed at Station 4, is an inclined fold, its southern limb being the steepest. The axis of this fold may be followed westward from Station 4 to Hopper Creek, where the fold is upright. At Station 4, the fold is evidently faulted at its axis, the upthrow being to the north. Near Station 4, there is an oil-spring and a wide outcrop of oil-sand. The southern limb of the fold is a very short one and is inclined at a very great angle. Oil-springs are marked with one star on the accompanying map. Farther eastward along this fold, all traces of a southern dip disappear as Piru Creek is approached. The direction and angle of the dip are very irregular, and there is an immense outcrop of sand more or less impregnated with petroleum. It is not improbable that at this point fold BB is overturned; i. e., bent over toward the south to such an extent that all the strata dip toward the north.

PHOTO 23. Concretionary Strata, Whitish Sandstone Formation, near Fortuna Oil-Wells, Ventura County.

PHOTO 24. Overturned Fold, Modelo Cañon, Near Piru, Ventura County.

Farther eastward along fold BB, the structure is very complex, and there is evidence of faulting. At Station 5 in Modelo Cañon, an anticlinal structure is seen, which lines up fairly well with the axis of fold BB; and it may not, perhaps, be too presumptuous to regard the fold at Station 5 as a continuation of that fold. Near Station 5 there is a bed of brea. Brea-beds are marked by two stars on the accompanying map. If a line were drawn from the axis of fold BB in Hopper Cañon along the line of strike in Modelo Cañon to Station 5, and then extended eastward to Piru Cañon, it would be found to reach Piru Creek not far from Station 6, where a well-defined anticlinal axis is exposed; but the inclination of this axis is to the north. (See Photo No. 34.) The rocks composing fold BB are, for the most part, shales, and contain sandstones, which, as before mentioned, constitute the lower portion of the shale formation.

5.1.27. Fold CC can be traced only a short distance west of Modelo Cañon. Near Station 7, on the north side of Modelo Cañon, an anticlinal structure is seen which coincides with the course of the axis of fold CC; but a short distance farther to the northeast the structure is that of a well-defined overturned fold. (See Photo No. 24.) The rocks constituting fold CC are shales and sandstones, the latter being exposed in the bottoms of the deep cañons.

5.1.28. Fold DD is exposed at Station 9 at the head of Modelo Cañon. (See Photo No. 33.) It is probable that the Sunset oil-wells in Hopper Cañon are situated on this fold. As previously mentioned, the Modelo wells are in the Modelo Cañon. Most of these wells are situated on the north slope of the fold, but some are on the south side. (See Photo No. 25.) The owners of the Modelo wells state that similar oil-yielding formations have been struck on both the north and the south sides of this fold. There are good reasons for believing that the strike of the axis of fold DD is west of north, and it is so marked on Fig. G. The rocks constituting fold DD are mainly whitish sandstone, which, as before mentioned, is capped with silicious shale a short distance north of the Modelo oil-wells. In some places the sandstone is impregnated with petroleum. It is said that one of the wells of the Modelo Oil Company penetrates oil-soaked sandstone for more than 500′.

5.1.29. Between fold AA and Piru Peak there appear to be four fault-lines. One of these is a short distance south of the axis of fold DD, a second is a short distance south of the axis of fold CC, a third on the south limb of fold DD, and a fourth between Modelo and Piru peaks. (See Photo No. 20.) Fig. G shows the position of the axis of fold DD, to the north of which a mass of sandstone, capped with shale, rises abruptly for about 1000′.

Reference to Fig. 11 shows that on Modelo Peak strata of shale pitch to the north at an angle of about 50°; and that on Piru Peak

strata of hard sandstone pitch to the south at an angle of about 50°. Taking into consideration the relative positions of the points referred to, it is evident that displacements must have occurred. (See Photo No. 20.)

5.1.30. North of Modelo Cañon, the geological structure is complex. Both the shale and the white sandstone formations are represented. Sands impregnated with petroleum are exposed at several points, notably as follows: In Lime Kiln Cañon, where, in the whitish sandstone formation, strata showing oil-stain may be observed; at Station 13 in Piru Cañon; at Station 12 in Piru Cañon, in the shale formation; and in Packard Cañon, where the shale is decomposed and impregnated with sulphur.

5.1.31. At Station 13, at the Narrows of Piru Creek, the axis of another fold is exposed, the strike of the fold being N. 80° E., or thereabouts. The formation exposed at Station 13 is whitish sandstone, and near the axis it is impregnated with petroleum.

5.1.32. In the vicinity of Station 14, on the east side of Piru Creek, there is a notable instance of local variation in geological structure, for the direction in which the strata dip is S. 50° E. It appears that a block of strata has been affected by some earth movement, probably block-tilting, which has given the strata a more easterly dip than that which prevails in the adjacent territory. The block of strata referred to shows a maximum thickness of about 2000′, as calculated from the exposed rocks. The formation is shale and sandstone. It is overlain by conglomerate, which is exposed farther eastward. At the point referred to, nearly all the sandstone strata are, or have been, impregnated with petroleum.

CHAPTER 2.

RECENT EXPLOITATIONS OF THE EOCENE FORMATIONS ON SESPE CREEK.

5.2.1. In the foregoing chapter certain formations were referred to as being the lowermost oil-yielding rocks in the Sespe district. The territory in which prospect wells have been drilled in this formation embraces what was formerly a portion of the Sespe oil-district in the vicinity of the Devil's Gate. (See Figs. G and H.) This territory is now included in the Devil's Gate oil-district. The boundaries of the district are as follows: "From center stake of south line of Sec. 1, T. 4 N., R. 20 W., S. B. M., continuing west 6 miles; thence north 8 miles; thence east 6 miles; thence south 8 miles, crossing the Big Sespe River to place of beginning, being part in T. 4, and part in T. 5 of aforesaid meridian."

(W. Cardwell of Temple Block, Los Angeles, Recorder.) Through the above-described territory the Sespe Creek has worn a cañon, the walls of which in some places rise to the height of more than 1000′ above the bed of the stream as shown in Bulletin No. 11, published by the California State Mining Bureau, Part 2, Chapter 1, Paragraphs 17 and 18. The formations which have been cut through by the Sespe Creek in the territory referred to consist of the Sespe brownstone formation, and an underlying formation consisting of a series of whitish and buff-colored sandstones and dark-colored shales; all these rocks being of Eocene age. (See Photo No. 27.)

As stated in Bulletin No. 11 (see Part 3, Chapter 2, Paragraphs 7 and 14), the writer is of the opinion that the formation underlying the Sespe brownstone contains a distinct oil-yielding horizon. When he investigated the Sespe district in 1896, he found oil-springs in this formation at the following places: On the Redstone Peak anticline, at Tar-Hole, near the Devil's Gate, and at the oil-wells then owned by the California Oil Company—all in the Sespe district; also at Echo Falls, north of the Silverthread oil-district.

In 1896, the only wells penetrating this formation were two on the Razzle Dazzle claim in the Sespe district, then belonging to the California Oil Company, and two abandoned wells of no great depth in Echo Cañon north of the Sisar Valley. At this writing, four wells have been drilled on the property formerly owned by the California Oil Company. These wells vary from 700′ to 1100′ in depth, and are said to produce about 1000 bbls. of oil a month.

As described in Bulletin No. 11, an anticlinal fold, the axis of which is well exposed at the head of Coldwater Cañon, may be traced eastward through the Tar-Hole claim and the Razzle Dazzle oil-claim. The southing of the axis of the fold between the Tar-Hole claim and the Razzle Dazzle is principally due to the fact that the south limb of the fold is much steeper than the north limb, and that the Razzle Dazzle is situated at a considerably greater elevation than the Tar-Hole claim.

5.2.2. The wells on the Razzle Dazzle claim, which are now operated by the Big Sespe Oil Company, penetrate formations immediately underlying the Sespe brownstone formation. (See record of Big Sespe Oil Company.)

5.2.3. The wells which are being drilled by Henley, Crawford & Co. are situated on the Tar-Hole and Mile-Square claims, respectively. These wells penetrate rocks which lie at a depth of more than 500′ below the Sespe brownstone. (See Photo No. 27.) The well sunk on the Tar-Hole claim is in the S.E. ¼ of Sec. 35, T. 5 N., R. 20 W., S. B. M. It is on the east bank of the Sespe Creek and north of the Devil's Gate. The drilling record of this well shows that the following strata were penetrated: Reddish shale to 80′; reddish shale with

heavy oil to 132′; blue shale and whitish sandstone to 240′; hard white sandstone (fissured) to 420′; blue shale and whitish sandstone to 562′. Enough gas to run a 30 H. P. boiler was struck at a depth of 382′. This well yielded about 40 bbls. of heavy oil a day. All the oil came from the reddish shale between the depths of 80′ and 132′. After well No. 1 had been drilled, well No. 2 was commenced. As shown in Fig. H, both these wells are situated near the axis of a fold. This fold was described in Bulletin No. 11 as the Coldwater Cañon fold. (See cross-section in Fig. H.)

Mr. Henley, who has made a careful study of the formations exposed at and near the last-mentioned wells, states that they are composed of the following strata:

Red shales	Sespe brownstone formation.
Fine-grained, dark-brown sandstone (good building-stone)	
Thick-bedded conglomerate and brown sandstone	
Red, oil-bearing shales	
Pearl-colored sandstones	Formation underlying Sespe brownstone.
Blue shales with strata of whitish sandstone	
Oyster shells. (This formation yields some oil.)	
Red shale	
White coarse sandstone	
Red shales (oil)	
Whitish sandstone	

5.2.4. There are several springs of petroleum issuing from the formations exposed in the Sespe Cañon to the north of the Henley & Crawford wells. Oil-claims have been located as far north as the Redstone Peak anticline. On the Sulphur Spring claim there is an extensive seepage of petroleum from strata of shale immediately underlying the Sespe brownstone formation. It is probable that this petroleum has its source in the same strata as those which yield the petroleum found on the Razzle Dazzle claim. North of the Sulphur Spring claim, the Sespe Creek traverses the syncline between the Coldwater and Redstone anticlines, and there appears to be a cross-fold running nearly north and south, the axis of which is cut through by the Sespe Creek. All the seepages along the Sespe Creek come from the formation immediately underlying the Sespe brownstone. Where the Sespe Creek has cut through the axis of the Redstone Peak anticline, there are springs of warm water accompanied by petroleum.

5.2.5. From the foregoing it appears that the rocks exposed in the territory between the Sespe and Piru creeks may be classed as follows:

First—Eocene rocks. These include the light-colored and whitish sandstones underlying the Sespe brownstone, the Sespe brownstone, certain drab sandstones, and dark-colored shales. In this series of rocks there are two horizons in which petroleum has been discovered: (1) In the formations underlying the Sespe brownstone and in the

lower strata of the brownstone formation; (2) In the upper strata of the Sespe brownstone formation, in the drab sandstones, and in the dark-colored shales. These formations were described in Bulletin No. 11, Part 2, Chapter 1.

Second—Lower Neocene (Miocene) rocks. These include a series of whitish sandstones, shales, and conglomerates, the whitish sandstone predominating. Petroleum is found in this formation at the Modelo and the Sunset oil-wells; and at several points these sandstones are more or less impregnated with petroleum.

Third—Middle Neocene formations. These include silicious shales, sandstones, clay-shales, and conglomerate, the shales predominating. In this series, petroleum is found in the sandstones interstratifying the lower portion of the shale formation. Petroleum is found in this formation at the Fortuna oil-wells and on the Piru ranch.

It is admitted that in California the Neocene formations lie non-conformably on the Eocene rocks, although the non-conformability is not everywhere apparent. The thickness of the formations mentioned is a difficult problem, owing to complex geological structure, and to our ignorance as to the amount of erosion which has taken place; still, some approximate estimates are in order. Thus, if the outcrop of the Eocene formations is traversed from the Sespe Creek to the bottom of the whitish sandstone, one might be led to assign to the Eocene formations exposed in the Sespe district a thickness of about 2 miles. In such case there is no doubt that the true thickness would be exaggerated, the great apparent thickness being due to faulting. If the whitish sandstone (Lower Neocene) formation is traversed from the Sespe Creek to the Agua Blanca Creek, the thickness might be estimated at nearly 1 mile, but in this case, also, the apparent thickness is exaggerated by faulting. It is probable that that portion of the Neocene series which includes the silicious shales, the sandstones immediately overlying them, and the clay-shales, is at least 5000′ in thickness.

CHAPTER 3.

PRODUCTIVE OIL-WELLS IN VENTURA COUNTY.

(Record made in June, 1900.)

5.3.1. The productive oil-fields on the south side of the valley of the Santa Clara River in Ventura County are: The Tapo Cañon field; the field operated by the South Pacific Oil Company in Eureka Cañon; the Torrey Cañon field; and the Bardsdale field. These oil-fields are situated, in the order in which they are named, on a ridge of mountains between

the Santa Clara and Simi valleys. The writer has not made a detailed examination of the formations penetrated by the wells in these fields, but the character of the exposed rocks leads to the conclusion that, for the most part, they belong to the Neocene shale formation described in this Bulletin.

The productive oil-fields on the north side of the Santa Clara Valley, in Ventura County, are: That operated by the South Pacific Oil Company on the south slope of Mount Cayetana; the Sespe district; the Hopper Cañon; that operated by the Modelo Oil Company in Modelo Cañon, and a portion of Piru Cañon. The wells in the Sespe district receive their oil from rocks of Eocene age. All the other remunerative wells on the north side of the valley of the Santa Clara River receive their oil from the lower portion of the Neocene series.

The productive oil-fields of the Santa Paula district are: The Ex-Mission oil-field, in which are the Adams Cañon, the Salt Marsh, the Wheeler, and the Scott & Gilmore wells; the Silverthread field, in which are the wells of the Los Angeles Transportation Company, the Bard, and the Astarte wells. This district includes also the Mark Jones or O'Hara wells on the east side of Santa Paula Creek. As stated in Bulletin No. 11, there is some doubt as to the age of the oil-yielding formations in the Santa Paula district. The character of the exposed rocks, however, warrants the assumption that most of the wells in the Santa Paula district receive their oil from the rocks belonging to the lower portion of the Neocene series.

PRODUCTIVE OIL-WELLS ON THE SOUTH SIDE OF SANTA CLARA RIVER.

5.3.2. *Tapo Cañon Oil-Wells* (Union Oil Company of Santa Paula, Ventura County, owners) are situated on the San Francisco ranch. This cañon is tributary to the Santa Clara Valley, and the wells are situated about 2 miles southeast of Camulos. The territory here named was developed during 1897–98–99, but produced no oil until 1900. In April, 1900, there were twelve wells in Tapo Cañon, varying from 300′ to 600′ in depth; yield about 300 bbls. a month; gravity of oil, 14.5° B; character of formations, sandstone and shale. It is said that less than half of these wells are productive. In Tapo Cañon there is one well 750′ deep, situated about a quarter of a mile south of the twelve wells previously mentioned. In April, 1900, this well was unfinished, but some oil had been struck. There is a 1200′ tunnel in Tapo Cañon, but it was abandoned, because, as the writer was informed, there was too much gas to allow of its completion.

5.3.3. *The South Pacific Oil Company* (of Los Angeles). The wells of this company (formerly belonging to the Eureka Company) are about 2 miles south of Piru in Lime Kiln Cañon, which is a tributary of the Santa Clara Valley. Here are fifteen producing wells, from 240′ to 850′

deep. In these wells oil was struck at a depth of from 85′ to 850′, and the yield of the wells varies from 5 to 60 bbls. of oil a day, the total amount being about 1600 bbls. a month. Some idea as to the life of these wells may be gathered from the fact that a few of the best wells started off at a yield of 60 bbls. a day, but after two years dropped to 20 bbls. a day. Seven men are employed at these wells. The gravity of the oil varies from 20° to 30° B.

5.3.4. *The Torrey Cañon Wells.* Torrey Cañon is a tributary of the Santa Ana Valley, and the wells here referred to are situated about 3 miles south of Piru. In May, 1900, four crews were drilling in this cañon, where there are now thirty-two producing wells, six having been abandoned. These wells vary from 500′ to 2000′ in depth; yield about 1500 bbls. a month, not counting the oil consumed at the wells for steam purposes. The gravity of the oil is about 28° B.

5.3.5. *The Bardsdale Wells* (Union Oil Company of Santa Paula, owners) are about 3 miles southwest of Fillmore, on the south side of the Santa Clara Valley. They are twenty-four in number, from 500′ to 1600′ in depth, and are said to yield about 6000 bbls. a month. Gravity of oil, about 28° B.

PRODUCTIVE OIL-WELLS ON THE NORTH SIDE OF THE VALLEY OF THE SANTA CLARA RIVER.

5.3.6. *The South Pacific Oil Company* (of Los Angeles). The wells of this company (formerly Loma oil-wells) are situated on the south slope of Mount Cayetana, about 4 miles east of Santa Paula. Here there are four producing wells from 600′ to 1200′ deep; yield said to be 1800 bbls. a month; gravity of the oil, 33° B.

5.3.7. *The Sespe District* is in the mountains on the north side of the valley of the Santa Clara River. The wells in this district, owned or controlled by the Union Oil Company, include the Kentuck, the Little Sespe, Four Forks, and the Tar Creek oil-wells. Here there are fifty-three wells, about twenty-two of which are productive. They yield about 6000 bbls. of oil a month; gravity of the oil varies from 27° to 35° B.

5.3.8. *Big Sespe Oil Company* (of Los Angeles, formerly the California Oil Company). The wells of this company are in the Sespe district. There are four wells from 600′ to 1000′ deep, and they yield 1000 bbls. of oil a month.

5.3.9. *Fortuna Wells* (Buckhorn Transportation Company, owners; A. Smith, of Los Angeles, president) are in Hopper Cañon about 2 miles north of Buckhorn Station. In April, 1900, this company had eleven producing wells, varying from 90′ to 600′ in depth; monthly yield, about 800 bbls.; gravity of oil, about 13.5° B.

5.3.10. *Sunset Oil Company's Wells* (Clark, Sherman & Co. of Los Angeles, owners) are in Hopper Cañon about 3 miles north of Buck-

horn Station. In April, 1900, this company had five wells, varying from 300′ to 600′ deep; monthly yield, about 500 bbls.

5.3.11. *Piru Oil Company* (of Piru, Ventura County) has three wells on the Temescal ranch near the mouth of Piru Cañon. These wells are from 400′ to 900′ deep. The formation is shale and sand. Total yield, 6 bbls. a day; gravity of oil, 20° B. Thirty men are employed at the Torrey Cañon wells. These wells yield enough gas for pumping, but not for drilling.

PRODUCTIVE OIL-WELLS IN THE SANTA PAULA DISTRICT.

5.3.12. *The Ex-Mission* group of wells is situated on the south slope of the Sulphur Mountains. As previously mentioned, this group includes the Adams Cañon, the Salt Marsh, the Wheeler, and the Scott & Gilmore wells. These wells are all either owned or controlled by the Union Oil Company, there being in all fifty-five wells, of which about thirty-seven are producing, and are said to yield about 2250 bbls. a month; gravity of oil, 25° to 30° B.

5.3.13. *Adams Cañon Oil Wells* (Union Oil Company of Santa Paula, owners) are about 6 miles northwest of Santa Paula and on the south side of the Sulphur Mountains. There are in the Adams Cañon thirty-five wells, varying from 130′ to 360′ in depth. The deepest well was drilled in 1900. Below the depth of 500′ the temperature in this well increased, and during the latter portion of the work the tools became too hot to be handled with the bare hands. The gravity of the oil in Adams Cañon is 26° B.

5.3.14. *The Salt Marsh Wells* are 1 mile west of Adams Cañon. Here are twelve wells, varying from 200′ to 2100′ in depth; gravity of oil, about 26° B. The oil was struck in a muddy, whitish sand.

5.3.15. *The Wheeler Cañon Wells.* No product.

5.3.16. *Scott & Gilmore Wells* are eighteen in number, and are from 200′ to 1000′ in depth; gravity of oil, about 23° B. There are thirteen men employed on the Ex-Mission leases. It is said that there are on the Ex-Mission grant fifty-four tunnels, which yield, all told, about 250 bbls. a month.

5.3.17. The wells of the Silverthread district are situated on the north side of the Sisar Valley. They include the wells of the Capitol Crude Oil Company, the Sisar Oil and Asphalt Company, and the Astarte wells.

5.3.18. *The Capitol Crude Oil Company's Wells* (Los Angeles Transportation Company, Los Angeles, owners) are situated on the north side of the Simi Valley. Here there are fifteen wells, eleven of which are productive, yielding about 1200 bbls. a month.

5.3.19. *The Bard Wells* adjoin the Capitol Crude Oil Company's wells on the west. Here there are twelve producing wells, which yield about 1200 bbls. a month.

5.3.20. *The Astarte Wells* (Union Oil Company of Santa Paula, owners). Five of these wells are productive, yielding 1000 bbls. a month; gravity of oil, about 21° B. Two men are employed.

5.3.21. *Mark Jones Oil Company* (O'Hara) wells are on the southwest slope of Mount Cayetana. Here there are five wells, said to produce about 400 bbls. of oil a month.

THE NORDHOFF DISTRICT.

5.3.22. *The Peri Oil-Wells* (Union Oil Company of Santa Paula, owners) are situated 1 mile west of Nordhoff. Here there are five wells, but it is said that only one of them is productive, yielding 2 bbls. a day. The formation is sandstone.

CHAPTER 4.

PROSPECT WELLS AND PROSPECTING IN VENTURA COUNTY.

(Many other prospect wells have been commenced in Ventura County since the writer visited that county in May, 1900.)

5.4.1. *Berkeley Oil Company* (E. North, superintendent). In June, 1900, this company commenced operations in Lecklar Cañon.

5.4.2. *Bradley & Hutton* (of Los Angeles) have one well in Hopper Cañon, about 1½ miles north of Buckhorn railroad station. In May, 1900, this well was 1000′ deep. Formation, silicious shale.

5.4.3. *Calleguas Wells* (Union Oil Company of Santa Paula, Ventura County, owners). In 1898 and 1899, thirty-two wells were drilled on the Calleguas ranch, about 12 miles south of Santa Paula, at the west end of the Simi Valley. The formation is said to be volcanic tuff. Oil was struck at a depth of from 150′ to 200′, and the wells appeared to promise a large production. Below the oil-yielding strata, water was struck, which displaced the oil, forcing it through some formation which has not yet been traced. This oil was orange color; so, also, was the residuum resulting from distillation, but when exposed to the air, the residuum blackened in a few days. The gravity of the oil is 14° B.

5.4.4. *Crude Oil Company* has a well situated on the ranch of M. Fine, about 1½ miles northwest of Fillmore. This well is 580′ deep, and is situated in Sec. 24, T. 4 N., R. 20 W., S. B. M.

5.4.5. *East Piru Oil Company.* In June, 1900, this company commenced operations in Lecklar Cañon.

5.4.6. *Henley, Crawford & Co.* (of Sespe, Ventura County) have two

wells in Sespe district a short distance north of the Devil's Gate. Well No. 1 is on the east side of Sespe Creek. Shale and sandstone of the Eocene age were penetrated to a depth of 562′. It is said that this well would yield 4 bbls. of heavy oil, but it is not pumped. Well No. 2 is on the west side of Sespe Creek. In this well the formation is similar to that penetrated by well No. 1, with traces of oil. In May, 1900, well No. 2 was 300′ deep.

5.4.7. *Kellerman Oil Company* (of Los Angeles) has two wells in Nigger Cañon, about 1 mile north of Piru. The first well is said to be about 900′ deep, and to be capable of yielding a few barrels of oil a day. This well is drilled on the axis of fold marked BB in Fig. A. The second well is drilled about 300′ north of the old well. It was not completed in June, 1900.

5.4.8. *McIntyre & Co.* (of Fillmore, Ventura County) have a well on the west bank of Sespe Creek, in the S.E. $\frac{1}{4}$ of the S.W. $\frac{1}{4}$ of Sec. 12, T. 4 N., R. 20 W., S. B. M.

5.4.9. *Nuevo Camulos Oil Company* has a well 950′ deep in Holser Cañon, about 3 miles northeast of Piru. Formation, shale and sandstone, with traces of oil. This well was not completed in June, 1900.

5.4.10. *Piru Oil Company* (of Piru, Ventura County) has a well on Fig Hill, Temescal ranch, and one at the Temescal ranch house. Formation of Fig Hill well: Adobe and shale to 20′; gravel to 35′; tough clay to 55′; hard shale to 90′; hard rock to 100′; sharp sand to 130′; soft sand to 170′; soft, fine sand to 355′; water; adobe and sand to 417′; shale to 432′; oil-sand to 452′; not specified to 597′; sand and shale to 620′; shells and sand to 665′; caving sand to 695′; soft sand to 715′; adobe to 740′; sand to 760′; adobe to 795′; hard sand to 800′; caving sand to 810′; hard sand to 821′; shale to 827′; running sand to 840′; oil-sand to 1030′; brown shale to 1035′; oil-sand to 1195′. This well yielded a small quantity of heavy oil, probably about 2 bbls. a day.

Formation of well at Temescal ranch house: Shell and shales, and broken oil-sand to 550′; black shale to 610′; hard oil-sand to 615′; black shale and oil-sand to 650′; black shale and shells to 675′; oil-sand and shale to 725′; hard shale to 730′; fine oil-sand to 788′; flinty shell to 790′; shale to 795′; oil-sand to 825′; oil-sand and shells to 840′; hard shells and sand to 868′; coarse sand to 900′; sand, shale, and conglomerate to 1200′. A small quantity of heavy oil was found in this well.

5.4.11. *Ramona Oil Company.* In June, 1900, this company was drilling at a point 4 miles northeast of Piru.

5.4.12. *Santa Ana Oil Company.* In June, 1900, this company was drilling at a point about 1 mile north of Piru.

5.4.13. *Western Oil Company* (of Pasadena; G. H. Coffin, secretary) has a well on the Ayers ranch, 9 miles northwest of Ventura. In June,

1900, this well was said to be 500′ deep, and to have struck a small quantity of oil. At that date it was not completed.

5.4.14. *Ranch No. 1* (Cora C. Howe, owner), located 9 miles north of Ventura. In June, 1900, a well was being drilled at the western end of Sulphur Mountain on this ranch.

5.4.15. *Santa Ana Ranch.* In June, 1900, a well was being drilled on this ranch by Messrs. Clark, Markham & Sherman, and others. It is situated on the south side of San Antone Creek, about 8 miles northeast of Ventura.

5.4.16. During the current year (1900) there has been much exploration of the more inaccessible portions of Ventura County in search of oil-lands, and trails have been cut over brush-covered mountains which heretofore have been almost inaccessible even to travelers on foot. One of the most interesting territories that has attracted the attention of the oil-prospector in Ventura County is Anacapa Island.

5.4.17. *Anacapa Island.* This island, which is about 25 miles north of Ventura, comprises an area of about 1140 acres. It has been located as oil-land by E. L. Barnard of Ventura, and others. It is said that there are numerous springs of bitumen and heavy oil on this island, and that oil rises from the ocean at several points adjacent to its shores. The formation is said to be sedimentary and eruptive rock.

PART 6.

SANTA BARBARA COUNTY.

CHAPTER 1.

THE SUMMERLAND OIL-FIELD, AND PRODUCTIVE WELLS IN SANTA BARBARA COUNTY.

6.1.1. In this county, the Summerland oil-field and the property of the Occidental Oil Company is the only oil-bearing territory yet developed, but prospect wells drilled in various portions of the county encourage the hope that the oil-fields of Santa Barbara County will eventually be found to be quite extensive.

6.1.2. There has been great development in the Summerland oil-field since it was reported on by the writer in 1896. In 1895 there were only 28 producing wells, with a production for that year of rather less than 1700 bbls. In June, 1900, there were more than 300 producing wells, and the annual production for 1899 was about 208,000 bbls.

The development of the Summerland oil-field has corroborated the opinions concerning it expressed by the writer in Bulletin No. 11, published by the State Mining Bureau in 1896; and the field has been extended in the directions suggested by the geological examinations recorded in the bulletin referred to. It is, however, somewhat remarkable that the oil-field has not been extended farther along the strike of the formation. The greatest development has been made in the direction of the dip, which necessitated the building of wharves into the ocean, from which numerous wells have been drilled. (See Photo No. 26.) This corroborates the statement made by the writer in Bulletin No. 11, p. 54, that the oil-yielding formations at Summerland extend south into the ocean. (See Fig. I.)

6.1.3. In drilling beneath the water, a casing larger than that needed for the drill-hole is put down to the floor of the ocean and forced into the bedrock until the ocean water is securely shut out of the drill-hole. This is called a conductor, and the casing of the well is put down inside of the conductor.

6.1.4. In wells sunk on the shore-line, the formation is yellow clay to 100′; sand with water to 120′; blue clay to 150′; sand with water to 180′; blue clay to 230′; oil-sand to 280′ (the oil from this strata shows a gravity of 12° to 14° B.); blue shale to 300′, and oil-sand to 400′.

The wells drilled beneath the ocean commence in blue clay. Along the shore-line the dip of the oil-sand varies from a few degrees east of south to a few degrees west of south, and the angle of the inclination is about 40°. At a distance of 300′ from high-water mark, the oil-sand was found to be lying nearly flat and to inclose pockets of clay. At a distance of about 600′ from the shore-line, a third bed of oil-sand was found overlying the uppermost stratum of oil-sand which had been penetrated near the shore.

6.1.5. The stratification of the oil-sand and the inclosing rocks, as shown by the well records, leads to the conclusion that the stress to which these formations have been subjected has produced great irregularity of structure. It is probable that the oil-yielding formations at Summerland belong to the Middle Neocene series, and that they rest non-conformably on the silicious shales of the Lower Neocene, which are exposed in the ridge of hills immediately north of Summerland, and near Carpinteria, about 6 miles to the east of Summerland. (See Bulletin No. 11, Part 3, Chapter 1.)

6.1.6. The depth of most of the Summerland wells ranges from 150′ to 300′. There are a few which are between 400′ and 500′ in depth, and there is one well which is 600′ deep. The cost of these wells is generally about $1 a foot, not including the cost of casing.

6.1.7. In June, 1900, there were at Summerland 305 producing wells, 59 abandoned wells, and 15 well-sites at which drilling operations had been commenced. These wells yield from 1 to 60 bbls. of oil a day, the average yield being 5 bbls. a day. The value of the oil in 1899 was 90 cents a barrel, f. o. b. at Summerland. The cost of production is said to range from 25 to 35 cents a barrel. The gravity of the oil varies from 10° to 16° B. Nearly all the lighter oils come from the deepest wells. The oil from the shallower wells contains a high percentage of water and sand.

6.1.8. The following is a list of companies engaged in oil-mining at Summerland in March, 1900, together with a statement of the number of productive wells:

OIL-PRODUCERS—SUMMERLAND OIL-FIELD.

Names.	No. of Wells.	Names.	No. of Wells.
Alameda O. & D. Co.	6	Oxnard Oil Co.	11
Baker, Geo.	2	Robinson	34
Churchill Bros.	11	Santa Barbara Oil Mining Co.	21
Duncan, J. T.	12	Seacliff Oil Co.	18
Duquesne Oil Co.	21	Seaside Oil Co.	34
Hancock & Parsons	3	S. P. Oil Co.	12
Lillis, J. C.	19	Steel, A. M.	2
Loomis, W.	5	Sunset Oil Co.	22
Miller, H. R.	6	Treadwell, J. B.	19
Miller, T. F.	5	Wilson, J. C.	34
Moore, W. M. S.	19	Williams Estate	9

6.1.9. As previously mentioned, many of the wells at Summerland are drilled beneath the ocean. They are connected with the mainland by wharves. (See Photo No. 26.) The length of these wharves is given in the following table:

NAMES OF OWNERS OF WHARVES IN SUMMERLAND.

(Record made in March, 1900.)

Duncan, J. T.	230′	Oxnard Oil Co. (branch)	340′
Duquesne Oil Co. No. 1	628′	S. P. Oil Co. No. 1	520′
Duquesne Oil Co. No. 1	305′	S. P. Oil Co. No. 2	520′
Lillis, J. C.	560′	Sunset Oil Co.	405′
Lillis, J. C.	340′	Treadwell, J. B.	1230′
Oxnard Oil Co.	734′	Weber, Churchill	336′

6.1.10. *The Occidental Oil Company* (of Santa Barbara) has six wells and one oil-tunnel in the Santa Ynez Mountains about 5 miles northeast of Summerland. It is said that only one of these wells is pumped, and that this well, together with the oil-tunnel, yields about 50 bbls. a month.

CHAPTER 2.

PROSPECT WELLS IN SANTA BARBARA COUNTY.

Only such wells are mentioned as had been drilled, or were being drilled, in June, 1900.

6.2.1. *Arctic Oil Company* (of San Francisco). Well No. 1, 7 miles south of Rincon Creek, 1825′ deep; formation, red sandstone; no oil. Well No. 2, 50′ distant from well No. 1, 2100′ deep; formation, red sandstone; no oil. Well No. 3, on the S. P. R. R., $1\frac{1}{4}$ miles east of Carpinteria; conglomerate and sandy shale to 700′; shale and sandstone to 1200′; liquid asphaltum; well abandoned.

6.2.2. *Buel Ranch Well*, 5 miles west of Santa Ynez; 900′ deep; much gas. Formation: soft white rock to 35′; asphaltum to 235′; shale and a little water to 470′; black sand to 480′; sand and water to 505′; shale and water to 510′, and quicksand and water. Water rose to within 40′ of the surface. Well abandoned. In June, 1900, a second well had been commenced.

6.2.3. *Careaga Well*, on Los Alamos ranch, about 6 miles west of Los Alamos. In September, 1900, the writer was informed that oil had been struck at a depth of 1140′.

6.2.4. *Casmalia Well* (M. Calligan, superintendent) is situated in

PHOTO 25. Modelo Oil-Wells, Ventura County. (Photo taken in 1898.)

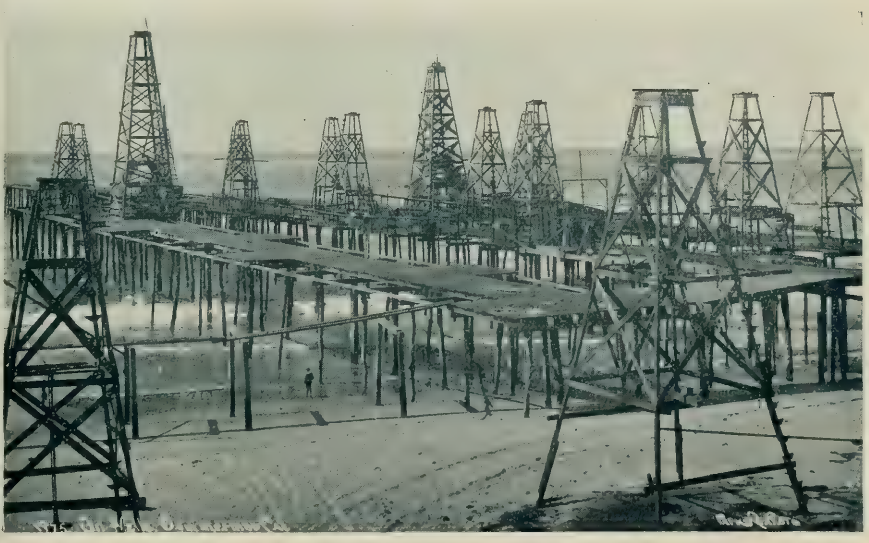


PHOTO 26. View on Shore-line, Summerland Oil-Field, Santa Barbara County.

Schuman Cañon, about 3 miles northeast of Casmalia station, on the S. P. R. R. In July, 1900, this well was 200′ deep. The formation is said to be a chalky-looking rock and shale. Drilling.

6.2.5. *Den Ranch Wells*, 3 miles west of Goleta. It is said that three wells have been drilled to a depth of between 200′ and 500′. Said to be abandoned.

6.2.6. *J. Heath* (of Carpinteria, Ventura County) has a well on the Hill ranch, on seashore near the mouth of Rincon Creek. Formation, shale to a depth of 400′. It is said that oil was struck at a depth of 150′, more oil showing as the well was deepened.

6.2.7. *Illinois Oil and Asphalt Company* (of Santa Barbara; A. L. Nelson, manager) has a well on seashore at Montecito. Formation: Yellow clay and sand to 200′; gas, blue clay, and quicksand to 260′; blue shale to 280.′ In June, 1900, this well was unfinished.

6.2.8. *Robinson Well*, on Joe Martin's ranch on seashore near Serena. Abandoned.

6.2.9. *Santa Barbara and Naples Oil and Land Company* (of Santa Barbara; E. W. Hayward, president). The territory operated by this company is about 15 miles west of Santa Barbara, near the seashore. In June, 1900, this company was drilling a well, the formation penetrated being principally shale to a depth of 450′, with some showing of gas and oil.

6.2.10. *Stevens, Clark & Duncan Well*, at Loon Point, about 1 mile east of Summerland; 500′ deep. Water and traces of oil. Abandoned.

6.2.11. *Treadwell Well*, on seashore between Loon Point and Serena. Said to be 500′ deep. Traces of oil. Abandoned.

PART 7.

THE SAN JOAQUIN VALLEY.

CHAPTER 1.

GEOLOGICAL SKETCH.

7.1.1. As is well known, the San Joaquin Valley constitutes the southern portion of the Central Valley of California. It is bounded on the east by the Sierra Nevada Mountains, and on the west by the Coast Ranges. The productive oil-fields that have been developed in this region are in the foothills of the Coast Ranges and the lowermost foothills of the Sierras at the southern extremity of the San Joaquin Valley. (See Fig. M.)

7.1.2. The formations to which the oil-yielding rocks of the San Joaquin Valley belong are the Eocene (Cretaceous B) and the Neocene; the latter formation having been deposited during an era which embraced the Miocene and Pliocene periods. Of recent years, geologists have decided that it is best to include the Miocene and Pliocene formations of California under the head of Neocene, and to divide the Neocene formations into the Upper, Middle, and Lower Neocene. The Eocene rocks are for the most part rather hard sandstones and dark-colored shales, with some strata of hard limestone. The sandstone is characterized by numerous concretions. In this formation are the most important beds of coal known in California. The only place in the Central Valley where valuable oil-measures have been developed in this formation is at Oil City, near Coalinga, on the western side of the San Joaquin Valley in Fresno County. At Oil City, an oil, remarkable for its low specific gravity, has been obtained from formations underlying rocks containing fossils of Eocene (Tejon) age.

7.1.3. At the time these rocks were deposited, the coast-line of California was east of the area now occupied by the foothills of the Sierras. The Central Valley of California was covered by the ocean, and the Coast Ranges were only partly elevated above the water. The early Neocene times must have been a period of depression, which allowed the deposition of the shale formation over a great portion of this region of the State. During the latter part of the Neocene epoch there was a marked period of elevation.

7.1.4. The Lower Neocene formations consist of a series of sandstones and shales containing Miocene fossils, and a series of shales which are remarkable inasmuch as they are composed principally of silica. In places they appear to be made up largely of diatomaceous remains. The exposed rocks are usually bleached, and they are sometimes found to be either white or whitish for a considerable depth below the surface. Professor Lawson, who has studied these shales, believes that they are made up largely of volcanic ash ejected by the volcanic eruptions which prevailed in California during the Neocene period. These shales are interbedded with numerous strata of chert and cherty limestone. They also contain a few strata of sandstone and diatomaceous earth. The sandstones are usually more or less impregnated with petroleum. In many places springs of heavy, tar-like bitumen issue from these shales, forming beds of impure asphaltum. Wells sunk in this formation in most instances yield a heavy, tar-like oil, and some of the wells drilled in the shales near Oil City yield an oil of medium gravity. There is little doubt that the Lower Neocene rocks rest non-conformably on the Eocene formations, for we find them resting on different material in different portions of the Coast Ranges. In most cases, however, they rest on the Eocene rocks, and very frequently it is difficult to detect any absolute non-conformability between the Lower Neocene and the Eocene rocks at their points of contact. In some places, as at the Sunset oil-wells in Kern County, the whitish shales show a thickness of several thousand feet. In the San Joaquin Valley these shales form a conspicuous feature in the scenery throughout a large portion of the foothills of the Coast Ranges. The only fossils found in the shale by the writer are marine diatoms, scales and bones of fish, and casts of *Pecten peckhami*, a Lower Neocene (Miocene) fossil.

7.1.5. Resting with apparent non-conformability on the colored shales are the Middle Neocene formations, in which are the most important oil-measures yet developed in the San Joaquin Valley. These are composed of a series of comparatively soft sandstones, bluish shales, and clay strata. The Middle Neocene formations contain numerous fossils, which, in point of age, range from Miocene to Recent. Collections of fossils were made from these formations in the foothills near Coalinga, in the Kettleman Hills, in the lower foothills of the Coast Ranges at Mud Creek in the San Emidio ranch, and at other places on the western side of the valley; specimens were also found in the lower foothills of the Sierras in the Kern River district. (See Bulletin No. 3.) A study of the Middle Neocene rocks in the direction of their vertical range shows a preponderance of Miocene fossils in the lower portion of the formation, and of Pliocene in the upper portion.

On the eastern side of the San Joaquin Valley, the Neocene rocks differ somewhat in character from those forming the foothills of the Coast

Ranges. The sandstones are interbedded with clay, and are made up largely of granitic material; volcanic ejectamenta appear also to have contributed to their composition.

The evidence of non-conformability between the Lower and Middle Neocene formations noted by the writer in the San Joaquin Valley is as follows: At Oil City near Coalinga, the whitish shale is very much disturbed; it stands at an angle of from 40° to nearly vertical, while the overlying formations are for the most part very little disturbed, and stand at an angle of less than 20°. East of the coal mines at Coalinga, sandstones containing fossils of Middle Neocene age rest on rocks which evidently belong to the Eocene series, although no fossils were found therein, and there is no intervening formation of white shale. On the east side of the valley, rocks containing fossils referable to the Middle Neocene age rest on granitic rocks. Moreover, in one place, at least, on the western side of the valley, the Middle Neocene rocks were found to contain fragments of bleached silicious shale. Throughout the greater portion of the San Joaquin Valley, the Neocene formations are covered with alluvium. These formations are evidently many thousands of feet thick, but the rocks are so covered with alluvium that it is difficult to determine the extent to which faults may have increased the apparent thickness.

7.1.6. The relation of the Neocene formations to the Eocene rocks is illustrated by Figs. K, L, 12, and 14. As recorded elsewhere in this Bulletin, a non-conformability between the Neocene and Eocene formations is observed in Los Angeles, Orange, and Ventura counties. The question of conformability and non-conformability between the Eocene and Neocene formations is very important. If the Neocene formations rested conformably on the Eocene, the oil-prospector would know that there might be a good chance of finding oil in the formations immediately underlying the Lower Neocene rocks, even though the Eocene rocks did not crop out at the surface.

7.1.7. The Neocene formations on the eastern side of the valley are much less disturbed than those on the western side. On the eastern side they are usually inclined at a very slight angle, generally less than 15°, while on the western side the inclination is seldom less than 20°, and sometimes as high as 70°. The reason of this is that the earth-movement which so greatly disturbed the rocks of the Coast Ranges at the close of the Neocene period, affected but slightly the Neocene formations in the foothills of the Sierras. The development of the remunerative oil-field at Kern River, on the eastern side of the San Joaquin Valley, where the formations are so slightly disturbed, warrants the assumption that other localities may be found where oil-yielding rocks which have been subjected to but very little disturbance form a wide and extensive oil-line. The place to look for such conditions is on the

east side of the San Joaquin Valley. As previously stated, a great drawback to prospecting in the lowermost foothills of the San Joaquin Valley is alluvium, which to a great extent covers the Neocene formations. It is also possible that comparatively undisturbed Neocene formations may be found in the foothills of the Sierras to the south of Tehachapai Pass.

CHAPTER 2.

PETROLEUM IN KERN COUNTY.

7.2.1. During the past two years there has been great development in the oil-yielding formations of Kern County, on both the eastern and western sides of the San Joaquin Valley. (See Fig. J.) On the western side numerous productive wells have been drilled in the Sunset oil-district and the McKittrick district. On the eastern side of the valley an extensive and promising oil-field has been developed in the Kern River district.

The geological formations in these localities were described by the writer in Bulletin No. 3, published by the California State Mining Bureau in 1894. Since there are still numerous demands for this bulletin, which is out of print, the writer feels that it is in order for him to quote liberally from what he then wrote.

7.2.2. "Petroleum and gas-bearing formations are found on both sides of the San Joaquin Valley in Kern County. In the Sunset oil-district and at Asphalto, on the western side of the valley, the petroleum and gas-yielding rocks are extensively exposed, and oil and asphaltum industries are carried on. In the Sunset oil-district there are also deposits of sulphur and gypsum. On the eastern side of the valley oil, bituminous matter, and gas are found, notably in T. 29 S., R. 28 E., M. D. M. Inflammable gas is found at the Barker ranch in Sec. 5, T. 29 S., R. 28 E., M. D. M. On the eastern side of the valley the showing of hydrocarbons (as indicated by the outcropping rocks) is insignificant when compared with that of the western side. This may be accounted for in part by the fact that, as previously mentioned, the geological disturbance of the Tertiary rocks of the western side is very great, while on the eastern side it is very slight. On the eastern side of the valley the Tertiary formation is well represented, as shown by the fossils collected in the vicinity of the Rio Bravo ranch. The writer obtained a small collection of fossils at the San Emidio ranch from strata overlying the formations which yield oil in the Sunset district, and a few from the oil-yielding rocks themselves."

"The numerous Pliocene fossils collected near the Rio Bravo ranch led to the conclusion that the formation exposed in that vicinity is more

recent than at San Emidio, although it would not be safe to assert such a generalization without obtaining a greater number of specimens from both localities. It is probable that Tertiary strata underlie the more recent formations in the valley lands of Kern County, unless there has been a much greater erosion of the Tertiary rocks than there is any reason to suspect." According to recent nomenclature, the fossiliferous rocks at Mud Creek, in the foothills of the Coast Ranges, and at Kern River, in the foothills of the Sierras, may be referred to the Middle Neocene series.

"As may be seen by examining the record of the strata penetrated by the wells which have been sunk for water in the valley lands of Kern and Tulare counties (see our XIth Report, pp. 233, 485), the recent filling of the valley appears to contain sufficient clayey strata to serve as a cover under which gas could be stored in underlying porous formations. A review of the situation, therefore, warrants the opinion that deep borings in the valley lands of Kern County would be quite likely to penetrate gas-yielding and possibly oil-yielding strata." As shown in the Bulletin from which the above quotations are made, the geological formations in the foothills of the Sierras at Kern River are of similar age to the rocks forming the first bench of foothills of the Coast Ranges at Mud Creek, on the western side of the San Joaquin Valley.

7.2.3. It is not surprising that evidences of petroleum should be found in the outcropping rocks of both localities, and that the discoveries of petroleum at Sunset and McKittrick were a prelude to the development of the Kern River oil-field.

CHAPTER 3.

KERN RIVER OIL-DISTRICT.

7.3.1. During the past twelve months an extensive and promising oil-field has been developed near the Kern River on the eastern side of the San Joaquin Valley in Kern County. (See Fig. J and Photo No. 28.) It is interesting to note that the initial developments in this field were made in a township to which attention had been drawn by the California State Mining Bureau, on account of the evidences of petroleum therein contained. Indeed, the outcrop of bituminous sand which led to the drilling of the first well in the Kern River oil-field was described, and its position noted, in the VIIth Report of the California State Mining Bureau, page 63, and in Bulletin No. 3 on "The Oil and Gas Yielding Formations of the Central Valley of California."

The Kern River oil-field, as far as it has been developed, comprises an area of about 12 square miles, and is situated partly in T. 28 S., R. 27 and 28 E., and partly in T. 29 S., R. 28 E., M. D. M. Within

PHOTO 27. Sespe Brownstone and Underlying Formations, Looking Southeast from Tar Hole, Sespe Cañon, Ventura County.

PHOTO 28. Kern River Oil-Field, from the South Bank of Kern River, Kern County.

this area in August, 1900, about 130 wells had been drilled, and many others had been commenced. These wells are drilled in groups, and some of the groups are nearly a mile apart. The depth of these wells varies from 450′ to more than 1000′. The formation penetrated is: First, alluvium or drift, which in few places exceeds 50′ in thickness; then a stratum of blue clay from 25′ to 350′ thick; beneath the blue clay is a water-sand from 10′ to 100′ in thickness; beneath the water-sand the formation consists of alternate strata of clay and sand. The well records show that most of these sands contain oil, and that in some instances they aggregate a thickness of more than 300′. The records shown in the accompanying table give an idea of the formation penetrated in the Kern River oil-field.

TABLE OF WELL RECORDS

Showing Formations Penetrated in the Kern River Oil-Field.

Reed Crude Oil Co.		*Reed Crude Oil Co.*		*Petroleum Center Oil Co.*		*Independent Oil and Development Co.*	
Sec. 34, T. 28, R. 28.		Sec. 34, T. 28, R. 28.		Sec. 8, T. 28, R. 28.		Sec. 28, T. 28, R. 28.	
Drift	30′	Drift	25′	Drift	50′	Sand and clay	450′
Blue clay	384′	Blue clay	315′	Clay and sand	300′	Oil-sand	550′
Water-sand	391′	Brown sand	400′	Oil-sand	450′		
Blue clay	450′	Oil-sand	480′				
Dry oil-sand	475′	Blue clay	495′				
Blue clay	500′	Oil-sand	588′				
Dry oil-sand	530′						
Blue clay	570′						
Oil-sand	643′						
Blue clay	658′						
Oil-sand	698′						

Gardner Oil Co.		*Comet Oil Co.*		*Canfield Oil Co.*		*Sacramento Oil Co.*	
Sec. 26, T. 28, R. 27.		Sec. 28, T. 28, R. 28.		Sec. 29, T. 28, R. 28.		Sec. 29, T. 28, R. 28.	
Sand and a few streaks of clay, water, and traces of oil	720′	Drift and blue clay	240′	Drift and blue clay	250′	Drift and blue clay	400′
		Oil-sand	380′	Conglomerate	300′	Water-sand	500′
		Cement	480′	Blue clay	360′	Blue clay	515′
		Oil-sand	720′	Oil-sand	725′	Oil-sand	730′

Graves Oil Co.		*Globe Oil Co.*		*Comet Oil Co.*		*Continental Oil Co. of Los Angeles.*	
Sec. 29, T. 28, R. 28.		Sec. 30, T. 28, R. 28.		Sec. 30, T. 28, R. 28.		Sec. 29, T. 28, R. 28.	
Drift, etc.	380′	Drift, etc.	300′	Drift and blue clay	390′	Drift, etc.	340′
Dry oil-sand	450′	Water-sand, blue clay, and dry oil-sand	550′	Water-sand	470′	Oil-sand	352′
Oil-sand	520′	Blue clay	580′	Blue clay	562′	Oil-sand and clay streaks	800′
Clay and shale	570′	Oil-sand	831′	Oil-sand	962′	Oil-sand, very rich	848′
Oil-sand	620′					Not through sand.	
Clay and shale	627′						
Oil-sand	710′						
Clay and conglomerate	714′						

TABLE OF WELL RECORDS—Continued.

Spillacy, Wood & Co.	*Century Oil Co.*	*Petroleum Center Oil Co.*	*Shasta Oil Co.*
Sec. 30, T. 28, R. 28.	Sec. 24, T. 28, R. 27.	Sec. 24, T. 28, R. 27.	Sec. 14, T. 28, R. 27.
Oil-sand at ----- 700′	Drift and reddish sandstone -------- 300′ Cemented sandstone -------- 330′ Brea ----------- 331′ Blue clay and sandstone --- 400′ Oil-sand ------- 402′ Hard-sand ----- 452′ Clay ---- ------ 472′ Water-sand; unfinished.	Sandy clay ---- 200′ Soft sandstone - 400′ Clay, sand, and water -------- 775′ Oil-sand; still drilling.	Volcanic ash --- 10′ Granitic sand --- 115′ Blue clay and sand ---------- 170′ Shaly, sticky clay ----------- 190′ Coarse blue sand 200′ Coarse sand and blue clay ------ 270′ Conglomerate, sand, and water 470′ Conglomerate and gas ------- 515′ Water-sand ----- 695′ Clay ----------- 710′ Water-sand --- - 750′ Sticky clay and oil and much gas ----------- 760′

These records were kindly furnished by the companies mentioned.

It is a difficult matter to estimate the thickness of oil-sand strata in a well which is yielding oil, especially when the formation is caving; but some of the operators in the Kern River field state that they have estimated the thickness of the oil-sand in their wells by carefully casing off all the strata as they went down, and that they found the oil-sand to be more than 300′ in thickness. It is unlikely that the oil-sands in the Kern River oil-field will prove of uniform thickness or uniformly saturated with petroleum, but the development at this date indicates that the Kern River oil-field is the largest developed oil-field in California.

The owners of the wells in the Kern River field state that their wells will produce from 40 bbls. to more than 100 bbls. of oil a day. Owing to lack of transportation, there has not been a sufficiently continuous production to warrant a definite statement by the writer as to the yield of the wells in this field. The oil is a black oil, and it is said to have a gravity of from 14° to 17° B. Much running sand accompanies the oil. Some companies separate the sand from the oil by running both into a slump-hole, where the sand settles; the oil is then pumped from the surface. Other operators pump the oil and sand into flumes furnished with riffles which are from 4″ to 8″ in height. The flumes are from 80′ to 300′ in length, and the riffles are from 8′ to 14′ apart, according to the grade of the flume. In a few instances, the oil is of such gravity that it has to be steamed in the well before it can be pumped. In a general way it may be said that there is very little gas in the Kern

River oil-field, although in some instances it is claimed that enough gas could be collected to supply fuel for steam purposes. The gas appears to be held in solution in the oil, and separates from it when brought to the surface.

In August, 1900, a spur was run from the main line of the S. P. R. R. to the Kern River oil-field.

7.3.2. There are very few rock-exposures in the Kern River oil-field. These show strata of clay and soft sandstone. The sandstone is light-colored and formed principally of granitic material. These rocks resemble the formations which may be seen resting on the granite a few miles northeast of the oil-field.

Between the oil-field and the granite the sandstone contains fossils which identify the formation as Middle Neocene. The best rock-exposures seen in the oil-fields are on the bank of Kern River, in Sec. 2, T. 29 S., R. 28 E., M. D. M. At this point strata of sandstone, somewhat impregnated with petroleum, dip to the west of south at an angle of less than 10°. It is difficult to estimate the precise direction of the dip of the oil-sand, even when the depth at which the oil-sand was struck has been given. The reasons of this difficulty are: First, it is impossible to tell whether or not the first oil-yielding stratum referred to in the different well records is the same stratum; second, it is evident that the strata vary in thickness within a short distance; third, the angle of the dip is so slight that it is necessary to use the records of wells which are far apart for the purposes of calculation; fourth, there is every reason to believe that the strata penetrated in the Kern River oil-field undulate.

Notwithstanding the difficulties referred to, the writer collated the well records kindly furnished him by the well owners in this oil-field. From these records it appears that in the northern portion of the field the strike of the oil-sand is about N. 30° W., the dip being S. 60° W. at an angle of less than 10°; and in the southern portion of the field, the strike is about N. 70° W., the dip being S. 20° W. at an angle of less than 10°. It is probable that N. 60° to 70° W. is the prevailing strike of the Neocene formations in the Kern River district.

7.3.3. In August, 1900, when the Kern River district was visited by the writer, the Kern River might be said to bound the developed portion of the Kern River oil-field on the south and east. The rock-exposures on the banks of the river show no evidence of any fault or line of geological disturbance to which the course of the channel of the Kern River might be attributed, and the terraced banks of the river indicate a long period of gradual erosion. There is a reasonable probability, therefore, that remunerative oil-yielding formations will be discovered on the south side of Kern River.

7.3.4. The history of the discovery of the Kern River oil-field is as follows: In June, 1899, J. Elwood & Sons dug a well on the ranch of Thomas Means near the outcrop of oil-sand mentioned in the VIIth Report of the California State Mining Bureau as being on the north side of the Kern River in Sec. 3, T. 29 S., R. 28 E., M. D. M. The Elwood well showed some oil at a depth of 35′. It was drilled with a hand auger to a depth of 60′, and yielded half a barrel of heavy oil a day.

In June, 1899, Elwood & Sons contracted with M. McWhorter to drill a well on Sec. 3, near the well which they had dug. At a depth of 350′ a 20-bbl. well was obtained. In July, 1899, E. R. Doheny & Butler organized the Petroleum Development Company, and purchased the land on which the discovery well had been drilled. This company drilled a 500′ well, which yielded 40 bbls. a day. In the same month, J. B. Treadwell sunk a well on the S. ½ of Sec. 3. This well was 450′ deep and remunerative.

Many other parties then commenced drilling. In December, 1899, the Kern River Oil Company drilled a well on Sec. 4, T. 29 S., R. 28 E., M. D. M. This well is 600′ deep, and yielded an oil of 14° B. specific gravity. It showed the extent of the oil-territory. There was a great rush to locate oil-claims, and every available piece of land adjacent to the discovery well was rapidly taken up.

7.3.5. The Barker ranch lies immediately north of the developed portion of the Kern River oil-field. Several prospect wells have been drilled on this ranch, as herein recorded. Up to August, 1900, no oil has been struck in these wells; but considerable quantities of gas, which from its odor is composed largely of sulphureted hydrogen, have been encountered. (See Barker Ranch, Prospect Wells.)

7.3.6. Active prospecting is also being carried on at Poso Creek, which is about 7 miles north of Kern River; and some shallow wells have been drilled on Cottonwood Creek, which empties into the Kern River about 7 miles east of the Kern River oil-field. In August, 1900, the writer could not learn that oil had been struck at either of these localities. (See prospect wells on Poso and Cottonwood creeks.)

7.3.7. The following is a list of operators in the Kern River oil-district in September, 1900, together with a statement of the number of drilling wells, completed wells, and derricks:

LIST OF OPERATORS IN THE KERN RIVER OIL-FIELD, SEPTEMBER 1, 1900.

Sec.	T.	R.	Names of Operators.	Drilling Wells.	Oil-Wells Completed	Derricks.
3	29	28	J. B. Treadwell	3	19	22
------	29	------	Petroleum Development Co.	2	15	20
------	29	------	San Joaquin Oil Development Co.	1	1	6
2	29	28	Petroleum Development Co.	----	1	1
------	29	------	Reed Crude Oil Co.	----	----	1
------	29	------	Hercules Oil Co.	1	----	1
4	29	28	Petroleum Development Co.	1	1	2
4	29	28	Revenue Oil Co.	----	5	5
------	29	------	Central Point Consolidated	1	8	10
------	29	------	Four Oil Co.	1	1	2
------	29	------	Kern River Oil Co.	1	4	6
------	29	------	Aztec Oil Co.	2	6	12
------	29	------	Grand Central Oil Co.	----	1	1
5	29	28	San Joaquin Oil and Development Co.	3	5	12
------	29	------	Monte Cristo Oil and Development Co.	2	2	5
20	28	28	Atlas Oil Co.	1	----	1
------	------	------	Reed Crude Oil Co.	1	----	2
28	28	28	Reed Crude Oil Co.	4	6	14
------	28	------	Comet Oil Co.	1	1	3
------	28	------	Independent Oil Co.	1	2	4
------	28	------	Petroleum Center Oil Co.	1	3	4
------	28	------	California Mutual Oil Co.	1	----	1
------	28	------	Kern Oil Co.	----	1	1
29	28	28	Graves Oil Co.	2	2	4
------	28	------	Sacramento Oil Co.	2	2	5
------	28	------	Canfield Oil Co.	2	4	7
------	28	------	Continental Oil Co., Los Angeles	1	1	3
30	28	28	Green & Whittier	1	2	3
------	28	------	Gem Oil Co.	1	----	1
------	28	------	Globe Oil Co.	1	2	5
------	28	------	Spillacy & Woods	2	----	3
------	28	------	Mt. Diablo Oil Co.	1	1	2
31	28	28	Senator Oil Co.	3	1	4
------	28	------	Green & Whittier	1	----	1
------	28	------	Fresno and Hanford Oil Co.	----	----	1
------	28	------	Sterling Oil Co.	1	2	4
------	28	------	Peerless Oil Co.	1	4	6
32	28	28	Reed Crude Oil Co.	1	2	6
------	28	------	Kern Oil Co.	1	1	4
------	28	------	West Shore Oil Co.	1	4	6
33	28	28	Imperial Oil Co.	2	2	5
------	28	------	Thirty-three Oil Co.	2	15	17
34	28	28	Reed Crude Oil Co.	1	6	11
------	28	------	Sol. Jewett	----	1	1
2	28	28	C. F. Gardner	1	----	----
26	28	27	Wm. Dingee, Jr.	1	----	----
24	28	28	Santa Barbara and Kern County Oil Co.	1	----	----

PROSPECT WELLS ON THE BARKER RANCH.

7.3.8. *Barker Ranch Development Company* (J. Dalzell, president) has two wells in Sec. 5, T. 29 S., R. 29 E., M. D. M. In well No. 1, the formation penetrated is as follows: Gravel and drift to 23′; brown shale to 33′; yellow shale to 63′; clay to 93′; blue shale to 340′; then a hard stratum of blue sand to 506′. This well yields warm flowing, sulphureted water and gas. In well No. 2 the formation penetrated is as follows: Clay to 10′; light-colored clay and diatomaceous earth to 40′; limestone and shale to 41′; diatomaceous earth to 90′; hard shell (the term "shell" is used by the drillers to signify a thin stratum of hard rock) to 91′; blue clay to 199′; hard shell to 200′; blue clay to 215′; hard shell to 216′; blue clay to 320′; soft shale to 321′; blue clay

to 460′; hard shell to 468′; blue sand to 509′; hard shell to 514′; blue sand to 542′; hard shell to 557′; blue clay and sand to 573′; shell to 574′; blue clay to 601′; shell to 609′; blue sand to 617′; shell to 622′; blue clay to 630′; shell to 631′; clay and sand to 640′; clay to 658′; clay and bowlders to 668′; cemented sand to 678′; black shale to 685′; sand and bowlders to 701′; hard shell to 704′; hard shale to 706′; bowlders to 707′; hard shell to 708′; clay to 711′; hard shell to 715′; sand and yellow clay to 743′; hard shell to 743½′; bowlders to 747′; sand to 765′; yellow clay to 778′; clay and sand to 802′; hard shell to 812′; blue clay and bowlders to 819′; shell to 825′; blue sand to 828′; dark-blue clay to 866′; blue clay to 872′; hard shell to 874′; blue clay to 876′; hard shell to 880′; yellow clay to 890′; shale to 896′; hard shell to 910′; soft blue shale to 916′; shale to 959′; blue shale to 969′. Drilling. No water.

7.3.9. *Beaver Oil Company* has a well in the S.E. ¼ of Sec. 36, T. 28 S., R. 28 E., M. D. M.

7.3.10. *Rio Bravo and White Range Oil Company* has a well near the west line of the N.W. ¼ of Sec. 30, T. 28 S., R. 29 E., M. D. M.

PROSPECT WELLS ON COTTONWOOD CREEK.

7.3.11. *Mount Adelaide Oil and Mining Company* (of Bakersfield; James P. Dougherty, president) has a 150′ well on the N.W. ¼ of Sec. 18, T. 29 S., R. 30 E., M. D. M.; also one 215′ well on the S.E. ¼ of Sec. 18, T. 29 S., R. 3 E., M. D. M.

PROSPECT WELLS ON POSO CREEK.

7.3.12. *Bachelors Oil Company* (of San Francisco) has a well near the center of Sec. 20, T. 27 S., R. 28 E., M. D. M.

7.3.13. *Cosmopolitan Oil Company* (of San Francisco; W. Gregg, president) has a well in the center of Sec. 32, T. 27 S., R. 29 E., M. D. M. Formation, blue clay and sand to a depth of 1033′. Drilling.

7.3.14. *Defiance Mineral Company* (of Bakersfield) has a well in the S.E. ¼ of Sec. 12, T. 27 S., R. 28 E., M. D. M.

7.3.15. *New Hope Oil Company* has a well on the S.E. ¼ of Sec. 29, T. 27 S., R. 27 E., M. D. M.

7.3.16. *Twenty-two Oil Company* has a well on the S. ½ of Sec. 22, T. 27 S., R. 27 E., M. D. M.

7.3.17. *Vishnu Oil Company* (of San Francisco; W. Gregg, president) has one well in Sec. 19, T. 27 S., R. 29 E., M. D. M. Formation, clay and sand with good water, which rose to within 100′ of the top of the casing. Drilling. This company has also a well in Sec. 30, T. 27 S., R. 29 E., M. D. M. Formation, blue clay, shale, and sand. Good water rose to within 110′ of the top of the casing. This company has also a well in the N.E. ¼ of Sec. 2, T. 28 S., R. 28 E., M. D. M.

PHOTO 29. Pacific Coast Oil Company's Wells, Pico Cañon, Los Angeles County.

PHOTO 30. Sunset Oil-Field, Kern County.

CHAPTER 4.

THE SUNSET OIL-DISTRICT.

7.4.1. The first locators of claims in the Sunset oil-district were the grantors of the Sunset Oil Company of Tulare. In January, 1890, the Sunset Oil Company leased their oil-claims in the Sunset district to Charles Barnard, who assigned a half interest in his lease to Messrs. Jewett & Blodget of Bakersfield, and eventually sold them his entire interest in the Sunset district.

7.4.2. Messrs. Jewett & Blodget sunk a group of thirteen wells, all within an area of about 400′ by 30′. These wells varied from about 80′ to 500′ in depth, except one well, which was 1300′ deep. These wells yielded, all told, about 15 bbls. a day, the gravity of the oil being about 12° B. A second group of wells was drilled by Messrs. Jewett & Blodget, about a mile southeast of their first wells. This group consisted of three wells from 820′ to 1350′ deep, and yielded about 15 bbls. of oil a day, with much water. The gravity of the oil was about 16° B.

7.4.3. Messrs. Jewett & Blodget also refined the asphaltum from the superficial deposits of the Sunset district. They used the heavy oil as flux. The refinery consisted of open kettles, and the refined product was shipped by team to Bakersfield, a distance of about 40 miles. The expense of transportation led to the suspension of the enterprise.

7.4.4. Messrs. Jewett & Blodget then sunk sixteen wells and three shafts in Sec. 13, T. 11 N., R. 24 W., S. B. M., and Sec. 18, T. 11 N., R. 23 W., S. B. M., and other wells were drilled as hereinafter recorded. (See Photo No. 30.) (See record of producing and prospect wells.) In August, 1900, it was said that there were eighteen producing wells in the Sunset district. The product of these wells is being refined by Messrs. Jewett & Blodget in their refinery in the Sunset district. (See Refineries.)

7.4.5. The Sunset oil-district is situated on the southwest side of the San Joaquin Valley about 40 miles from Bakersfield. (See Photo No. 30.) This district embraces T. 32 S., R. 23 and 24 E., M. D. M.; T. 12 N., R. 23 and 24 W., S. B. M.; T. 11 N., R. 22 and 23 W., S. B. M.; also that portion of T. 11 N., R. 24 W., S. B. M., lying east of the western boundary of Kern County; and includes the first two tiers of foothills of the Coast Ranges. The two tiers of foothills mentioned commence in the most northeasterly portion of the Temblor Mountains, and extend in a southeasterly direction until they sink in the mesa land between the foothills and the valley. (See Atlas, Figs. J, K, and M.)

7.4.6. The rocky strata throughout the foothills of this portion of the Coast Ranges are generally obscured by soil, which, except in dry seasons,

is productive of fair grazing during the spring. There is no potable water in the Sunset oil-district, although there are numerous saline springs. To the south of the district, tier after tier of mountainous ridges rises toward the dominant ridge of the Tehachapai range, as this portion of the Coast Ranges is named on the Kern County map. The northeastern slope, and the greater portion of the summit slope of the Tehachapai range, are covered with alluvium. On the summits of these mountains there are not only grazing, but also agricultural lands. Potable water is found in springs and also by digging in the bottoms of ravines; and, although, as the writer is informed, several dry wells are often dug before water is obtained, the water-supply, except in dry seasons, appears to be sufficient for the requirements of the inhabitants.

7.4.7. The rocky formations which impinge on the southern portion of the Sunset oil-district constitute the mountainous ridges previously mentioned on the northeastern slope of the Tehachapai range. These ridges are, for the most part, formed by faults and minor folds in the stratified rocks supplemented by erosion. The strike of this formation, in a general way, is northwesterly. No fossils were found in this formation, but its lithological character resembles that of the San Emidio Cañon, where a small collection of fossils was obtained. Dr. J. G. Cooper found these to consist of two orders: (*a*) Fossils from thick sandstone strata, which are referred by him to the Tejon group of the Eocene age, formerly called Cretaceous B; (*b*) Miocene fossils, also from thick sandstone strata. As previously mentioned, the Miocene and Pliocene formations are grouped under the head of Neocene.

7.4.8. The rocky formations of the Sunset oil-district will now be enumerated in what appears to be the order of their relative stratigraphical superposition. (See Fig. 12.) The geological periods to which they respectively belong can only be inferred from the few poorly preserved fossils obtained in this locality, and from the physical resemblance of the rocks themselves to the rocks of other formations on the eastern slope of the Coast Ranges, which are richer in palæontological evidence. The oldest rocks exposed in the Sunset oil-district consist of sandstone, calcareo-silicious rocks and impure limestone, dark-colored shales, massive light-colored shales showing a hackly fracture, strata of sandstone with rounded concretions, calcareous sandstones, and fine calcareous conglomerate. The exposures of formation are scarce, and the few that exist show great geological disturbance. Within short distances, the strata frequently dip in opposite directions and at different angles of inclination; the prevailing dip, however, appears to be northeasterly. This formation yields springs of sulphureted brines, and in one place a small quantity of greenish oil accompanies the brine, but no calcareous tufa nor any solid bituminous deposit is formed. No fossils were found in these strata. The most characteristic features

FIG. 12

SECTION SHOWING APPROXIMATELY THE MAXIMUM THICKNESS OF LIGHTCOLORED SHALES EXPOSED IN THE SUNSET OIL DIST. KERN CO.

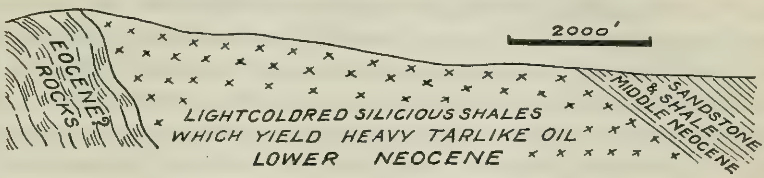


FIG. 13

SECTION OF TERTIARY STRATA IN KETTLEMAN HILLS. (MIDDLE NEOCENE.)

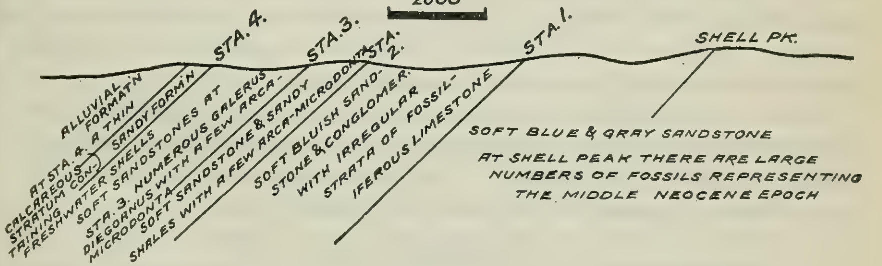
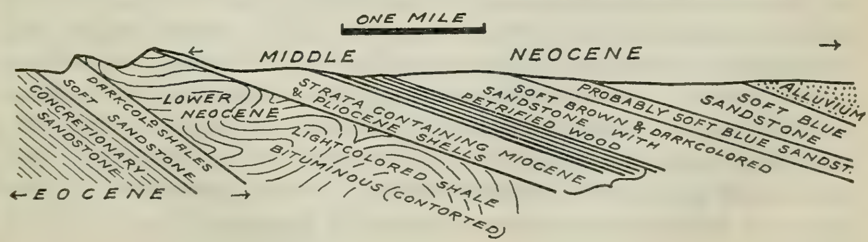


FIG. 14

SECTION THROUGH OIL CITY FIELD FRESNO COUNTY



of this formation are the dark-colored argillaceous shales, and the sandstone containing rounded concretions. The stratigraphical position and the physical character of this formation warrant the assumption that it belongs to the same geological horizon as do the Eocene shales and sandstones underlying the light-colored silicious shales in the oil-district 9 miles north of Coalinga in Fresno County. Overlying the formations, which we may tentatively class as Eocene, in the Sunset district, is a formation composed mainly of light-colored silicious shales, and constituting the first tier of foothills. (See Fig. 12.) These shales are for the most part of a brownish color when first mined, but they become almost white under the action of the atmosphere; indeed, the outcroppings of this rock are white or light-colored for several feet beneath the surface. In some places, the bleaching of these shales can be traced directly to the action of sulphureted vapor.

7.4.9. This light-colored silicious shale is by far the most characteristic rock of the bituminous formations; much of it is of low specific gravity and porous, sticking readily to the tongue, and is easily scratched. Some of it, however, especially in the lower portion of the formation, is indurated, apparently by the infiltration of silicious water. Occasionally pieces of this shale are found which show silicious induration only in the outer portions of the laminæ of which it is composed, and a cross-fracture reveals soft, light-colored shale within.

7.4.10. The chemical composition of these shales is as interesting as their physical appearance, the characteristic feature being the large amount of silica they contain. Two specimens from the Sunset oil-district were examined which showed as follows:

	Insoluble in Acid.	Silica Soluble in Sodium Carbonate.	Total Amount of Silica.
(*a*)	99 per cent	12 per cent	98 per cent
(*b*)	91 per cent	24 per cent	89 per cent

7.4.11. The light-colored shales are much less disturbed than the formation on which they rest. The prevailing direction of the dip of the light-colored shales in the Sunset oil-district is N. 30° E., and the angle of inclination is in some places as low as 20°, while in others it is as high as 80°. Although the southern limit of the light-colored shale in the district is tolerably well defined, it is not unlikely that in some places, where this shale has escaped erosion, it may extend a long way up the northeastern slope of the Coast Ranges. In one instance, a well was dug at an altitude of nearly 3000′, in which light-colored shales, similar in appearance to those found in the lower foothills, were penetrated.

7.4.12. Investigations in various parts of the Coast Ranges warrant

the classification of these shales as Lower Neocene (Miocene); there is reason to believe that they rest non-conformably on the underlying rocks.

7.4.13. Numerous seepages of heavy petroleum exude from these shales, forming beds of asphaltum, which, in some places, before these deposits were mined by Messrs. Jewett & Blodget, extended over an area of several acres. This asphaltum, much of which remains, is principally black, pitch-like bitumen, varying from solid to viscous, and some of it is of a yellowish-brown color; it is of different degrees of purity, and existed not only in beds and mounds, but was found by excavation to extend beneath the superficial drift. In some of these beds the bones of animals and stone mortars and other Indian relics were found beneath four or five feet of asphaltum.

7.4.14. When this territory was visited by the writer in 1894, he found that Messrs. Jewett & Blodget had drilled and dug twelve wells from 80′ to 500′ in depth in the shale formation; these wells are all within an area of 300′ in length by 40′ in width. They yielded, all told, about 15 bbls. of oil in twenty-four hours. The specific gravity of the oil varied in the different wells from about 12° B. to a liquid asphaltum which required to be heated by steam before it could be pumped.

7.4.15. In several places springs of brine and sulphureted water issue from the light-colored shales.

7.4.16. Overlying the light-colored silicious shales is a formation composed largely of comparatively soft sandstone. In the Sunset district only a few rocks belonging to this formation are exposed; they contain Middle Neocene fossils. (See Bulletin No. 3.) At Lobos Creek, on the San Emidio ranch, this formation is seen resting on the light-colored silicious shale. Between Lobos Creek and Mud Creek, a small collection of fossils was made from this formation. These were classified by Dr. J. G. Cooper and found to represent the Middle Neocene age. (See Bulletin No. 3.)

7.4.17. Near Coalinga in Fresno County, as hereinafter mentioned, the writer found evidence of this formation resting non-conformably on the light-colored shales, and in some places it contained fragments of shale, apparently similar to the light-colored silicious shales previously mentioned. At the Sunset oil-wells and in the Coalinga district, oil-sands are found in lower beds of this formation.

7.4.18. In 1892–93, Messrs. Jewett & Blodget drilled three wells in Sec. 28, T. 11 N., R. 25 W., S. B. M. Although at the point where the wells are drilled the rocks are covered with alluvium, there is little doubt that these wells penetrate Middle Neocene formations. The record of one of the wells is as follows:

WELL NO. 1.

Sulphur and apparently calcareous tufa deposited by mineral water	45′
Very hard gray and blue sandstone	80′
(At a depth of 58′ there was a little oil and some mineral water.)	
Gray sandstone with soft streaks and more mineral water	160′
(At this depth the casing was reduced to 8⅝″.)	
Soft blue sandstone, with hard shells and more water	402′
(At this depth the casing was reduced to 6⅝″.)	
Blue sandstone	420′
(At this depth the water was shut off.)	
Coarse sandstone, with oil and water and much gas	440′
Light blue sand	445′
Sand, with water	820′

This well was cased from the depth of 420′ to that of 820′ with 5″ casing. Superintendent Youle states that this well was tested, and that about 100 bbls. of brine and 6 bbls. of oil were pumped from it daily for three months. It also furnished enough gas for a cook-stove.

7.4.19. Many of the wells being drilled in the Sunset district in August, 1900, appeared to penetrate strata immediately overlying the light-colored shales and belonging to the Middle Neocene formation; the character of this formation is further shown by the record of the Monarch well, which penetrated a series of clays and sandstones. (See record of Monarch well.) The oil obtained in this formation is of lower gravity than that obtained in the silicious shale formation. In the shale formation it is usually about 10° or 11° B., but in the Sunset district the oil from the Middle Neocene formations varies from 14° to 17° B.

7.4.20. Associated with the rocks of the Middle Neocene age are white silicious sandstones, which appear to have been hardened by infiltering water. There is also a soft gypseous rock, which rests nonconformably on the older formations. In the eastern portion of the Sunset oil-district, and about a mile eastward therefrom, this white gypseous rock attains a thickness of several feet and forms low hills on the mesa-land. It may also be seen resting upon the upturned edges of older strata at an altitude of nearly 2000′. A specimen of this white rock was examined in the laboratory of the State Mining Bureau, and was found to be composed of sulphate and a carbonate of lime and clayey matter. There are also deposits of calcareous tufa and breccia, apparently of later age than the Neocene rocks. A description of the Sunset district would be incomplete unless some mention were made of its deposits of sulphur and gypsum.

7.4.21. The deposits of sulphur in the Sunset district are found under the following conditions: As drift cemented with sulphur, as irregular masses of sulphur in the drift, as sulphur incrusting and filling fissures in the rocks, as sulphurous earth, or as sulphurous precipitate from the waters of mineral springs. The sulphurous earths are frequently black, contain bituminous matter, and have a strongly acid taste and fetid odor. The sulphur deposits appear to follow fissures in the rocks, the

prevailing trend being N. 80° E. The sulphur is evidently formed by the decomposition of sulphureted hydrogen. In some places these sulphur deposits have been prospected by excavation to a depth of 10′ or 12′. These deposits are not worked.

7.4.22. The principal deposit of gypsum in the Sunset district is situated in its southeastern borders. The gypsum forms a stratum of rather soft, chalky-looking rock, and in some places it attains a thickness of several feet. It is mixed, containing much carbonate of lime and chalky clay.

CHAPTER 5.

WELLS IN SUNSET OIL-DISTRICT.

The following records were obtained in August, 1900:

PRODUCING WELLS.

7.5.1. *Monarch Oil Company* (of Arizona; E. Aigeltinger, president) has a well in the N.W. ¼ of Sec. 2, T. 11 N., R. 24 W., S. B. M. In July, 1900, this well was 500′ deep. It is a flowing well and is said to yield 75 bbls. of oil a day. The formation penetrated by this well is: Drift and water-sand to 260′; hard stratum to 266′; blue clay to 311′; brown sand and a little oil to 336′; oil-sand to 350′; hard stratum to 358′; blue clay to 388′; sand and heavy oil to 396′; blue clay to 488′, and oil-sand to 495′.

7.5.2. *Jewett & Blodget Oil Company* has sixteen wells in the S.E. ¼ of Sec. 13, T. 11 N., R. 24 W., S. B. M. These wells vary from 250′ to 400′ in depth. The formation penetrated is principally shale. It is said that these wells yield from 10 to 25 bbls. of oil a day. Gravity of oil, 11° B. This company also has a well 875′ deep in the S.W. ¼ of Sec. 18, T. 11 N., R. 23 W., S. B. M. The formation is principally shale. There are two strata of oil-sand.

PROSPECT WELLS.

7.5.3. *Acme Oil Company* (of Los Angeles; E. V. Van Norman, president) has a well in the S.W. ¼ of Sec. 12, T. 11 N., R. 24 W., S. B. M. In July, 1900, this well was 300′ deep. Formation, shale, with good showing of oil. Drilling.

7.5.4. *Bachelors Oil Company* (of San Francisco) has a well in Sec. 22, T. 11 N., R. 24 W., S. B. M. It is said that there is a good showing of oil in this well.

7.5.5. *Barrett Oil Company* (of San Francisco) has a well in the N.E. ¼ of Sec. 11, T. 11 N., R. 24 W., S. B. M. In July, 1900, this well was

1025′ deep. Formation, mostly shale and clay, with a good showing of oil. Gravity of oil, 14° B. Drilling.

7.5.6. *Golden Gate Oil Producing Company* (of Stockton, San Joaquin County; D. O. Castle, president) has a well 400′ deep in Sec. 13, T. 11 N., R. 24 W., S. B. M., but it was abandoned on account of water. This company also has a well in the S.E. ¼ of Sec. 2, T. 11 N., R. 24 W., S. B. M. Drilling.

7.5.7. *Lion Oil Company* (E. B. Weed of San Francisco, president) has a well in the S.E. ¼ of Sec. 12, T. 11 N., R. 24 W., S. B. M. Drilling.

7.5.8. *Manhattan Oil Company* (of Los Angeles; A. C. Jones, president) has a well in the S. W. ¼ of Sec. 11, T. 11 N., R. 24 W., S. B. M. Drilling.

7.5.9. *Navajo Oil Company* (of Los Angeles; R. R. Burns, president) has a well 200′ deep in the N.W. ¼ of Sec. 20, T. 11 N., R. 23 W., S. B. M. Formation, shale, with a good showing of oil. Drilling.

7.5.10. *Pittsburg Oil Company* (of Bakersfield; F. S. Benson, president) has a well in the N.W. ¼ of Sec. 1, T. 11 N., R. 24 W., S. B. M. In July, 1900, this well was 800′ deep. Formation, clay-shale and sand. Drilling.

7.5.11. *State Crude Oil Company* (of Los Angeles; G. W. Whiteford, president) has a well in the S.E. ¼ of Sec. 14, T. 11 N., R. 24 W., S. B. M. Formation, principally shale. Drilling.

7.5.12. *Sunset Bakersfield Crude Oil Company* (of San Francisco; H. F. Bulwer, president) has a well in the N.W. ¼ of Sec. 13, T. 11 N., R. 24 W., S. B. M. In July, 1900, this well was 800′ deep. Formation, blue shale. This well yields flowing sulphureted water. Abandoned. This company also has a well in the N.W. ¼ of Sec. 21, T. 11 N., R. 23 W., S. B. M. In July, 1900, this well was 325′ deep. Formation, black shale, with some oil. Gravity of oil, 11° B. Drilling.

7.5.13. *Sunset Czar Oil Company* (of Pasadena, Los Angeles County; B. W. Hahn, president) has a well in the N.W. ¼ of Sec. 19, T. 11 N., R. 23 W., S. B. M. Drilling.

7.5.14. *Sunset King Oil Company* (of Los Angeles; B. W. Hahn, president) has a well in the N.E. ¼ of Sec. 10, T. 11 N., R. 24 W., S. B. M. Formation, blue shale. Drilling.

7.5.15. *Sunset Petroleum and Refining Company* (of Los Angeles; J. W. Evans, secretary) has a well 100′ deep in the N.W. ¼ of Sec. 29, T. 11 N., R. 24 W., S. B. M. Good showing of oil. Drilling.

7.5.16. *Sunset Queen Oil Company* (of Los Angeles; L. Vickery, president) has a well in the N.W. ¼ of Sec. 14, T. 11 N., R. 24 W., S. B. M. Formation, shale. Drilling.

7.5.17. *Western Mineral Oil Company* (of Bakersfield; Gordon Blanding of San Francisco, president) has a well in the S.E. ¼ of Sec. 17, T. 11 N., R. 23 W., S. B. M. In July, 1900, this well was 800′ deep. Formation, black shale, with some gas. Drilling. This company has

also a well in the N.W. ¼ of Sec. 27, T. 11 N., R. 23 W., S. B. M. In July, 1900, this well was 1400′ deep. Formation, shale, with a little oil of high specific gravity. Drilling.

CHAPTER 6.

THE McKITTRICK DISTRICT.

7.6.1. The railroad depot at McKittrick is about 25 miles northwest of the Sunset district. The road between the two places lies over the lowermost foothills of the Coast Ranges. Along this road there are very few rock-exposures, but they are sufficient to show that the rocks forming the lower foothills between Sunset and McKittrick belong to the Middle Neocene formation; while the white slopes of the upper foothills indicate the white outcropping shales of the Lower Neocene age. At the time this locality was visited by the writer, prospect wells were being drilled in the foothills between Sunset and McKittrick by the Bay City, the Pacific Consolidated, and the Hartford oil companies. (See record of prospect wells in McKittrick district.)

7.6.2. The McKittrick district, including the Temblor district, embraces the following townships: T. 29 S., R. 20 and 21 E.; T. 30 S., R. 21 and 22 E.; T. 31 S., R. 22 and 23 E.; and also that portion of T. 30 S., R. 20 E., lying east of the western boundary of Kern County—all in M. D. M. This area extends more than 20 miles along the western foothills of the Santa Maria Mountains, and has a width of about 10 miles. The foothills in which the oil-wells and asphaltum-beds at McKittrick are situated are, for the most part, covered with alluvial soil, which, except in dry seasons, sustains a scanty herbage during the spring, but in many places there is an abundant growth of greasewood and sagebrush.

7.6.3. The first portion of the territory, now known as the McKittrick district, to be developed was the lowermost bench of hills which rises from the mesa land to the north of the McKittrick railroad depot. (See Photo No. 31.) These lands were patented about thirty years ago by Garibaldi, Jo Queralo, and others, and the patents include the asphaltum-beds at what is now called McKittrick.

In 1866 the Buena Vista Petroleum Company erected a still about 3 miles northwest from where McKittrick now stands, at the spring now owned by Miller & Lux. This still had a capacity of 300 gallons. The oil was taken from pits and open cuts, and had a gravity of from 10° to 12° B.; but it is said that at a depth of 30′ oil was obtained having a gravity of 21° B. About 3000 gallons of refined oil were produced, but,

owing to the expense of transportation and other difficulties, the enterprise was abandoned. Subsequently Blodget & Weil of Bakersfield sunk a 300′ well, and at this depth there is said to have been a good showing of oil. In 1887, J. S. Hambleton and others drilled a 565′ well, in which the oil rose to within 3′ of the top of the casing. Later the Buena Vista Petroleum Company erected a refinery of three kettles to refine the superficial deposits of asphaltum, but this enterprise was abandoned. In 1893, when McKittrick, then called Asphalto, was visited by the writer, several companies were holding oil-land there; and a railroad had been built to it from Bakersfield. The Standard Asphalt Company, which had leased and acquired a large tract of oil and asphaltum land, had erected an asphaltum refinery of twelve kettles, each of which was 12½′x 5′x 3′. This refinery was erected to refine the superficial deposits of asphaltum. The enterprise would have been a failure but for the discovery of veins of asphaltum about 1½ miles southeast of McKittrick. Until 1900 large quantities of asphaltum were obtained from these mines. The refinery first erected by the Standard Asphalt Company was burned down, but a new one was built about 1½ miles southeast of the old site. This refinery consisted of twelve kettles, having a capacity of about 60 tons. Here the asphaltum from the asphaltum mines was refined until January, 1899, when the company practically suspended operations, making only occasional runs. The new works were called Asphalto, and the site of the old works, McKittrick.

In 1893, the Buena Vista Oil Company had a 410′ well, from which 22 bbls. of oil a day had been pumped, and a 92′ well which yielded about 3 bbls. of oil a day. Oil was also obtained for the asphaltum refinery from several dug wells.

In 1898, Melton McWhorter erected a small refinery at McKittrick, where he manufactured paint, axle-grease, and other compounds from the crude oil. In February, 1899, McWhorter, Berry, Keller & Spencer leased a portion of the land operated by the Buena Vista Petroleum Company. These gentlemen then formed the El Dorado Oil Company and drilled several wells, which were unsuccessful; but in the autumn of 1899 they drilled a 600′ well, which is said to be productive.

In the spring of 1899, McWhorter, Berry, Keller & Spencer sublet 40 acres to J. B. Treadwell, who drilled a 450′ well. This well was completed in May, 1899, and proved very productive. Subsequently other companies drilled in this district, as hereinafter noted. It is said that in this district the oil-sand has been penetrated for 300′. In August, 1900, there were sixteen producing wells in the McKittrick district, and seven prospect wells were being drilled, not including the wells in the Temblor district; several other wells were about to be commenced.

7.6.4. The formations most extensively exposed in the McKittrick

district are light-colored silicious shales similar to those seen in the Sunset district. The outcropping rocks, which represent the formations resting on the silicious shales, are very scanty; they consist mainly of porous silicious rock containing marine diatoms, bituminous sandstones, and clayey and sandy strata. In some places the diatomaceous rocks contain petroleum, and in connection with the bituminous sandstones previously mentioned, they doubtless constitute oil-sand in the oil-wells at McKittrick. The diatomaceous rocks also contain a large amount of salt. A good exposure of these saline rocks may be seen in the N.W. cor. of Sec. 33, T. 30 S., R. 22 E., M. D. M., where a small cañon extends in a southwesterly direction. During the summer, a crust composed principally of salt forms on the surface of the saline rocks. A short distance from the outcrop of the saline rocks, the sides of the cañon are formed of soft sandstone, the loose sandy surface of which is in some places strewn with quartzose pebbles, fragments of silicious rock, and a few marine shells. In 1894 the writer collected several of these shells, and two well-known forms, identified among them by Dr. J. G. Cooper (see Bulletin No. 3), showed that the formation overlying the light-colored silicious shales at McKittrick belongs to the Middle Neocene series. At McKittrick there are extensive superficial deposits of asphaltum, which have exuded near the contact of the silicious shales and the Middle Neocene formations. The dip of the exposed rocks at McKittrick is about N. 30° E., and in many places the rocks stand at a very high angle, 60° or more. The strike of the formation corresponds to that of the oil-line, which is about N. 60° W.

7.6.5. The formation penetrated by the productive wells in the McKittrick district is that portion of the Middle Neocene formation which immediately overlies the light-colored silicious shales. The oil-yielding strata are inclined at a very great angle, which makes the oil-line a narrow one. It is said that in July, 1900, about 9000 bbls. of oil were sold from the McKittrick field. The gravity of the oil in this field ranges from 15° to 20° B.

Following the strike of the formation in a northwest direction from the oil-wells south of the McKittrick railroad depot, the character of the débris covering the hills and occasional outcropping ledges of rock, evidence the proximity of the sandstone and diatomaceous rocks. The sandstones are frequently oil-soaked, and seepages of maltha may be seen in nearly every cañon. These features warrant the conclusion that the source of the oil and maltha is at or near the contact of the sandstone and the diatomaceous rocks.

7.6.6. About 1½ miles west of the McKittrick depot there is a cliff of light-colored sedimentary strata, some of which are bituminous and some interspersed with fragments of silicious shale resembling the silicious shale of the Lower Neocene. In 1894 the writer noted a vein

of very pure asphaltum at the base of this cliff. To the south of the stratum forming this cliff porous silicious shales are seen, but as investigation is made in a southerly direction across the strike of the formation, the light-colored shales lose their porous character and appear to be indurated by silica. In a few places there are weather-worn masses of limestone. Still farther to the south the light-colored shale is covered with alluvial soil, which, except in dry seasons, produces excellent pasturage during the spring.

7.6.7. About half a mile by a trail to the southeast of the McKittrick depot, there is a spring of warm mineral water, which yields inflammable gas and a little oil. The gas smells strongly of sulphureted hydrogen.

The asphaltum deposits at Asphalto are found under two conditions: (1) as superficial deposits of impure asphaltum; and (2) as veins of asphaltum in the Middle Neocene formations. The superficial deposits of asphaltum have been formed by exudation of heavy oil; they originally covered a good many acres, and were from 1′ to 12′ thick. This asphaltum varies greatly in quality; some of it is brownish in color and resembles ironite. It is frequently dry and powdery, and more or less mixed with earth. The best asphaltum in these superficial beds lies near the surface; in some places it forms a stratum varying in thickness from a few inches to two feet or more. This stratum consists principally of a dull-black, compact asphaltum, but some of it possesses a pitch-like luster, and here and there it is rendered viscous by fluid petroleum. Beneath the upper stratum the asphaltum is frequently impure and rotten, and interbedded with drift. Attempts to mine and refine this asphaltum have proved unprofitable.

7.6.8. The principal asphaltum mines are 1½ miles southeast of McKittrick. In these mines the asphaltum occurs as irregular veins and intrusive masses in the Middle Neocene rocks. These veins are from a few inches to five feet or more in thickness. In one of the workings that the writer examined in 1894, the foot-wall is light-colored clay and the hanging-wall soft sandstone.

In a cut made by miners who were prospecting for petroleum in the N.E. ¼ of Sec. 34, T. 30 S., R. 22 E., M. D. M., several strata of impure asphaltum 1″ to 1′ in thickness were cut through. The asphaltum was found to be interbedded with thin strata of light-colored clay, sand, and pebbles. One of the uppermost strata, which is composed of dark-colored sand, is fossiliferous and contains fresh-water shells. These strata dip N. 80° E. at an angle of about 50°. In 1894 the writer submitted specimens of these fresh-water shells to Dr. J. G. Cooper, who found them to be living forms. (See Bulletin No. 3, p. 49.) These asphaltum mines were successfully worked for several years.

7.6.9. *The Temblor Oil-Field* is about 12 miles northwest of the rail-

road depot at McKittrick, and is considered a portion of the McKittrick district. In August, 1900, there were three productive wells in this field, and six prospect wells were being drilled. The gravity of the oil ranges from 18° to 20° B., and the rocks penetrated resemble the lower portion of the Middle Neocene formation hereinbefore described.

CHAPTER 7.

WELLS IN McKITTRICK DISTRICT.

PRODUCING WELLS.

7.7.1. *California Standard Oil Company* (of Oakland; J. M. Merrill, president) has a 450′ well and two 500′ wells in the S.W. ¼ of Sec. 20, T. 30 S., R. 22 E., M. D. M. Formation: Asphaltum, shale, clay, and sand. It is said that in June, 1900, the 450′ well yielded 150 bbls. of oil a day by pumping, and that one of the 500′ wells yielded 40 bbls. and the other 75 bbls. a day. Gravity of oil, 22° B. This company has also three wells in Sec. 28, T. 30 S., R. 22 E., M. D. M. It is said that in July, 1900, these wells were about 600′ deep, with a good showing of oil. Drilling.

7.7.2. *Climax Oil Company* (of San José) has two wells in the Temblor field in the N.E. ¼ of Sec. 36, T. 29 S., R. 20 E., M. D. M. Formation: Soft shale and sandstone. A flow of oil was struck at 285′. It is said that in July, 1900, these wells were producing 30 bbls. a day each. Gravity of oil, 15° B. This company has also a producing well in the N.E. ¼ of Sec. 29, T. 29 S., R. 20 E., M. D. M.

7.7.3. *El Dorado Oil Company* (of Bakersfield; C. J. Berry, president) has a producing well 450′ deep in the N.E. ¼ of Sec. 29, T. 30 S., R. 22 E., M. D. M. It is said that in June, 1900, this well yielded 50 bbls. of oil a day. Gravity of oil, 20° B. On this quarter-section, oil was struck by the El Dorado Company in three wells, which were unfinished in July, 1900.

7.7.4. *Giant Oil Company* (of San Francisco; W. J. Dingee, president) has two wells in the N.W. ¼ of Sec. 13, T. 30 S., R. 21 E., M. D. M. Formation: Shale, clay, and sandstone. Oil-sand was struck at a depth of 700′ and penetrated to a depth of 1050′.

7.7.5. *Kern River Oil Company* (of San Francisco; C. Reise, president) has three wells, each 800′ deep, in the N.E. ¼ of Sec. 13., T. 30 S., R. 21 E., M. D. M. One of these wells is a flowing well. In July, 1900, they were said to yield, all told, about 200 bbls. a day by pumping.

7.7.6. *San Francisco McKittrick Oil Company* has an 800′ well in

the N.E. ¼ of Sec. 14, T. 30 S., R. 21 E., M. D. M. In July, 1900, it was said to yield 25 bbls. a day.

7.7.7. *Shamrock Oil Company* (of San Francisco; J. W. Wright, president) has three wells in the S.E. ¼ of Sec. 19, T. 30 S., R. 22 E., M. D. M. Formation: Clay, shale, and sandstone. These wells are each about 800′ deep. Oil-sand was struck at a depth of about 700′. In July, 1900, it was said that each of these wells would yield 50 bbls. of oil a day by pumping.

7.7.8. *J. B. Treadwell Oil Company* has six wells in the S.E. ¼ of Sec. 20, T. 30 S., R. 22 E., M. D. M. These wells range from 400′ to 500′ in depth. Formation: Sand and shale impregnated with asphaltum. It is said that in June, 1900, these wells were pumped and yielded, all told, about 450 bbls. a day. Gravity of oil, about 20° B.

THE TEMBLOR OIL-FIELD—PRODUCING WELLS.

This district is about 12 miles northwest of McKittrick Station.

7.7.9. *Climax Oil Company* (of San José; S. F. Lieb, president) has three wells in the N.E. ¼ of Sec. 36, T. 29 S., R. 20 E., M. D. M. In well No. 1 the following formation was penetrated: Soft limestone to 20′; yellow shale to 35′; blue shale to 100′; brown shale to 250′, and oil-sand to 322′. In well No. 2 a similar formation to that in well No. 1 was penetrated to a depth of 285′, and then oil-sand to a depth of 330′. Below this depth the sand contained sulphureted water. In well No. 3 the formation passed through to a depth of 280′ was similar to that penetrated for the first 290′ in well No. 1, then oil-sand to a depth of 340′. The casing in these wells is not perforated. Well No. 2 is a flowing well, and yields about 30 bbls. of oil a day. Wells Nos. 1 and 3 yield about 10 bbls. of oil a day. The gravity of these oils ranges from about 18° to 20° B.

McKITTRICK DISTRICT—PROSPECT WELLS.

7.7.10. *Bay City Oil Company* (of San Francisco; G. W. Turner, president) has a well in Sec. 22, T. 32 S., R. 22 E., M. D. M., about 12 miles from McKittrick. Drilling.

7.7.11. *El Modelo Oil Company* (of Fresno; C. L. Waters, president) has a well in Sec. 24, T. 30 S., R. 21 E., M. D. M. In July, 1900, this well was about 1000′ deep, with some showing of oil. Drilling.

7.7.12. *Hartford Oil Company* (of Los Angeles; J. S. Dillon, president) has a 650′ well in Sec. 12, T. 31 S., R. 21 E., M. D. M., about 6 miles south of McKittrick. Formation, principally shale.

7.7.13. *National Oil Company* (W. C. Beattie of Oakland, president) has a well in the N.E. ¼ of Sec. 29, T. 30 S., R. 22 E., M. D. M. Formation, shale and sandstone. Oil was struck at 1100′. Drilling.

7.7.14. *Pacific Consolidated Oil Company* (of Fresno) has a 700′ well

in Sec. 2, T. 31 S., R. 21 E., M. D. M., about 15 miles from McKittrick. It is said that oil-sand has been struck in this well.

7.7.15. *Sloan Oil Company* (of Los Angeles) has a well in the S.E. ¼ of Sec. 20, T. 30 S., R. 22 E., M. D. M. In this well a stratum of oil-sand was struck at 680′, and a second stratum at 775′. Gravity of oil, 20° B. Drilling.

7.7.16. *Virginia Oil Company* (of San Francisco; J. W. Wright, president) has a well in Sec. 29, T. 30 S., R. 22 E., M. D. M. In July, 1900, this well was 800′ deep, with some showing of oil. Drilling.

TEMBLOR OIL-FIELD—PROSPECT WELLS.

7.7.17. *Diamond Oil Company* (of San José) has a well in the N.W. ¼ of Sec. 11, T. 29 S., R. 21 E., M. D. M. Drilling.

7.7.18. *Eureka Oil and Development Company* (of Bakersfield; A. J. Lightner, president) has a well in Sec. 13, T. 29 S., R. 20 E., M. D. M. Formation, sandstone and a little shale. Oil struck at 80′. Gravity, 10° B. This well is being drilled with a portable rig, run by a gasoline engine. It is furnished with a steel cable carrying a string of tools weighing 1750 lbs. The rig was designed by G. M. Bobs of Los Angeles.

7.7.19. *Gould & Center Oil Company* has a well near the center of Sec. 18, T. 29 S., R. 21 E., M. D. M. In July, 1900, this well was about 200′ deep, with a good showing of oil.

7.7.20. *J. Jameson* (of Bakersfield) has a well in Sec. 31, T. 29 S., R. 20 E., M. D. M. In August, 1900, this well was 100′ deep. Formation, shale. Drilling.

7.7.21. *Nevada Oil Company* (of Bakersfield; M. Wagy, president) has a well 1000′ deep near the center of Sec. 24, T. 29 S., R. 20 E., M. D. M. Drilling.

7.7.22. *Sunrise Oil and Development Company* (of San José; O. L. Baker, president) has a well in the S.W. ¼ of Sec. 11, T. 29 S., R. 21 E., M. D. M. Formation: Alluvium and gravel to 240′; blue shale to 300′; soft sandstone to 340′; brown shale to 410′; sandstone to 460′. Some gas. Drilling.

CHAPTER 8.

THE DEVIL'S DEN DISTRICT.

7.8.1. This district adjoins the McKittrick district on the northwest. It embraces T. 25 S., R. 17, 18, and 19 E.; T. 26 S., R. 17 and 18 E.; T. 27 S., R. 18 and 19 E.; T. 28 S., R. 19 and 20 E.—all in M. D. M.; and that portion of T. 27 S., R. 18 E., lying east of the western boundary of Kern County.

7.8.2. In this district, the same sequence of formation was noticed as that heretofore described as forming the foothills of the Coast Ranges on the west side of the San Joaquin Valley, viz: the Middle Neocene sandstones and shales, the silicious shales of the Lower Neocene, and rocks which in physical appearance resemble the Eocene formations noted at Coalinga, in Fresno County. In August, 1900, there were no productive wells in the Devil's Den district, but four companies were drilling prospect wells. (See prospect wells in Devil's Den district.)

PROSPECT WELLS.

Only such wells are mentioned as were drilled, or being drilled, in August, 1900.

7.8.3. *Devil's Den Development Company* (of Visalia; A. R. Orr, president) has a 100′ well in the N.W. ¼ of Sec. 22, T. 25 S., R. 19 E., M. D. M.

7.8.4. *Imperial Oil and Development Company* (of San Francisco; E. C. Calvin, president) has a well in Sec. 27, T. 26 S., R. 17 E., M. D. M., about 6 miles southeast of Annette P. O.

7.8.5. *Raven Pass Oil Company* (of Los Angeles; M. A. Newmark, president) has a well in Sec. 23, T. 26 S., R. 17 E., M. D. M. Formation, sandy shale. Well said to be 400′ deep, with traces of oil. In June, 1900, this well was unfinished.

7.8.6. *Spreckels* (*R.*) (of San Francisco) has a 600′ well in the N.W. ¼ of Sec. 30, T. 25 S., R. 18 E., M. D. M. Formation: Hard sandstone to 60′; blue shale to 160′; hard stratum to 165′; black carbonaceous material to 170′; gas to 460′; hard, dark-colored shale interstratified with soft shale to 500′; and hard sandstone to 560′. Drilling in dark-colored shale.

CHAPTER 9.

THE KREYENHAGEN DISTRICT.

7.9.1. The Kreyenhagen district adjoins the Devil's Den district on the north, and is partly in Fresno County and partly in Kings County. It embraces T. 21 S., R. 16, 17, and 18 E.; T. 22 S., R. 16, 17, and 18 E.; T. 23 S., R. 16, 17, and 18 E.; T. 24 S., R. 17 and 18 E.; and such portions of T. 22 S., R. 13, 14, and 15 E.; T. 23 S., R. 15 and 16 E.; T. 24 S., R. 16 E., as lie east of the western boundary of Fresno and Kings counties—all in M. D. M.

This district includes the Avenal oil-field, which extends as far south as the sixth standard line of the Mount Diablo meridian, and the Kettleman Hills, which rise between Tulare Lake and the main foothills of

the Coast Ranges, being separated from the latter by the Kettleman Plains.

7.9.2. In the Avenal oil-field, the Avenal Land and Oil Company is operating on a ridge which rises to an altitude of more than 2000′. (See Avenal Land and Oil Company.) In August, 1900, this company was drilling at a point on this ridge where it is cut through by Tar Cañon. In this cañon there are seepages of heavy, tar-like oil, which in one place has formed a small quantity of asphaltum. The before-mentioned ridge is composed of shale and sandstone, principally sandstone, and some of the sandstone is highly impregnated with petroleum. These rocks dip about N. 10° E. at an angle of from 60° to 75°. They contain fossils of Miocene age. (See Bulletin No. 3, and Table II at the end of this volume.) Some of the strata are highly fossiliferous, but the fossils are in a poor state of preservation. The formation composing the ridge must be regarded as Lower Neocene, and probably underlies the light-colored shales which are here covered by the Middle Neocene formation. The formations on the south slope of this ridge show strata of soft sandstone and sandy shales. To the north and at the foot of this ridge, the formation is soft blue sandstone, and the dip of the rocks appears to be more easterly and at a somewhat lower angle than that of the rocks forming the ridge. In 1893 the writer obtained a collection of fossils from this sandstone, which shows it to belong to the Middle Neocene age. (See Bulletin No. 3, p. 54.)

7.9.3. The Kettleman Hills are immediately north of the ridge on which the wells of the Avenal Oil Company are situated. A reconnaissance of these hills shows that their more elevated portions are formed of soft blue sandstone, and that their summits rise to an altitude of about 1000′. The summits of these hills present a rounded, undulating appearance, while their sides are furrowed by narrow gulches and ravines deeply cut in the comparatively recent formations. Near the summits of these hills the blue sandstone is interbedded with a few calcareous strata containing fossils which represent the latter portion of the Middle Neocene age. (See Bulletin No. 3, p. 54.)

7.9.4. One of the uppermost strata on the western slope of these hills contains fresh-water shells, but the fossiliferous portion is of no great thickness. The fresh-water shells obtained from this locality were classified by Dr. J. G. Cooper, who found that they were mostly living forms, which in point of age ranged downward to the Pliocene. (See Bulletin No. 3, p. 55.) An idea of the formation of the western slope of the Kettleman Hills may be gathered from Fig. 13.

In August, 1900, several prospect wells were being drilled in the Kettleman Hills, but the writer could not learn that any oil had been struck. (See Kettleman Hills—Prospect Wells)

7.9.5. On the Kreyenhagen ranch there are oil-seepages in cañons which cut through rocks of similar appearance to those seen in Tar

Cañon in the Avenal district. These rocks are well exposed on the south fork of the Zapato Chino Creek, where it breaks through the first tier of the higher foothills. Some of these rocks contain Miocene fossils. (See Bulletin No. 3, p. 55.) It is evident that these rocks, like those of Tar Cañon, must be classed as belonging to the Lower Neocene formations. As seen on the Kreyenhagen ranch, they contain three distinct strata of oil-sand. The uppermost stratum of oil-sand has a heavy black oil; the middle ledge also has a heavy oil, and the lower ledge yields a peculiar green oil of high specific gravity.

7.9.6. In August, 1900, there had been or were being drilled in the Kreyenhagen district the following wells: In the Avenal field, two prospect wells; in the Kettleman Hills, seven prospect wells; on the Kreyenhagen ranch, two producing wells and five prospect wells.

PRODUCTIVE WELLS.

7.9.7. *Black Mountain Oil Company* (of Los Angeles; E. R. Schneider, president) has an 800′ well in the S.W. ¼ of the N.W. ¼ of Sec. 33, T. 22 S., R. 16 E., M. D. M. Formation: Dark-colored shale to 80′; white sand to 85′; dark shale to 400′; light-colored shale to 550′; shale and sand with oil to 570′; light-colored shale to 640′; oil-sand to 660′; shale to 700′; oil-sand to 720′. Operations were suspended in order to use the oil for drilling. This company has also a well in the same section about 600′ from well No. 1. Formation resembles that in No. 1. Drilling.

7.9.8. *Kreyenhagen Oil Company* (of Los Angeles; J. H. Henderson, president) has two wells in the S.E. ¼ of Sec. 32, T. 22 S., R. 16 E., M. D. M. In one of these wells the formation is as follows: Dark-colored shale to 400′ (a water stratum was struck at a depth of 125′, and another at 400′); dark-colored shale to 650′; oil-sand to 660′. This is said to be a 15-bbl. well, and yields a light-green oil; gravity, 38° B. Work was suspended on this well that it might be a source of fuel for the other wells. The Kreyenhagen Oil Company has another well 1350′ deep. The formation is shale, with streaks of sand showing traces of oil at 1000′ and 1100′ and water at 1200′. Drilling.

PROSPECT WELLS.

7.9.9. *Avenal Land and Oil Company* (of San Francisco; A. B. Williamson, president) has two wells in Tar Cañon, in the E. ½ of the E. ½ of Sec. 18, T. 23 S., R. 17 E., M. D. M. In one of these wells the formation is: Adobe to 20′; oil-sand with water to 70′; blue water-sand to 140′; clay to 235′; shale to 521′; oil-sand to 555′; shale to 590′; sand showing traces of oil to 635′; shale to 802′; blue clay to 900′; sand with traces of oil to 984′. Drilling. The other well is a prospect well not yet completed.

7.9.10. *Baby King Oil Company* (of Hanford; Mr. Griswell, presi-

dent) has one 1125′ well in the N.E. ¼ of Sec. 11, T. 23 S., R. 16 E., M. D. M. Oil of 30° B. specific gravity was struck at 400′; and at 1100′ oil of 18° B. specific gravity; a short distance below this depth flowing water was encountered, and the well abandoned.

7.9.11. *Consolidated Oil and Development Company* (of Hanford) has two wells in the N.E. ¼ of Sec. 10, T. 23 S., R. 16 E., M. D. M. One of these wells is 1100′ in depth. A good showing of oil was obtained at 1050′. The oil obtained from this well is of an amber color, and has a specific gravity of 20° B. Drilling.

7.9.12. *Kings County Oil Company* (of San Francisco; T. E. Lamb, president) has a 500′ well in the S.W. ¼ of the S.W. ¼ of T. 23 S., R. 16 E., M. D. M. Formation: Black shale, blue sandstone, and brown sandstone containing oil. This well was abandoned on account of water. This company also has a well in the S.W. ¼ of the N.E. ¼ of Sec. 3, T. 23 S., R. 16 E., M. D. M. Formation: Clay and soil to 12′; white shale to 29′; black shale to 65′; black sand to 67′; black shale to 90′; hard gravel to 120′; black shale to 275′; gravel to 285′; black shale to 410′; blue sand-rock to 450′; water-sand to 490′; blue sand-rock to 540′; sand to 556′; clayey sandstone to 600′; black shale to 660′; clayey sandstones to 696′; hard shale to 720′; hard rock, sandstone predominating, to 900′. Heavy oil was struck at a depth of 240′. This company has also a well 140′ deep.

7.9.13. *St. Lawrence Oil Company* (of Hanford, Kings County) has a well in the S.E. ¼ of the N.E. ¼ of Sec. 12. It is said that oil was struck at the bottom of the well.

KETTLEMAN HILLS—PROSPECT WELLS.

7.9.14. *Esperanza Oil Company* (of Hanford; D. L. Barney, president) has two wells, one 1100′ deep, abandoned on account of water, and one 840′ deep, operations suspended. These wells are in the S.W. ¼ of Sec. 14, T. 22 S., R. 17 E., M. D. M.

7.9.15. *Florence Oil Company* (of San Francisco; D. Donan, president) has two 720′ wells in the N.W. ¼ of Sec. 15, T. 22 S., R. 17 E., M. D. M. In one of these wells much gas was struck. Operations suspended. In August, 1900, this company was drilling a well for water.

7.9.16. *Gibbs Oil Company* (of Hanford; E. M. Gibbs, president) has a 500′ well in the N.W. ¼ of Sec. 28, T. 21 S., R. 17 E., M. D. M. Drilling.

7.9.17. *Iowa Oil Company* (of Hanford; Louis Decker, president) has a 260′ well in the S.W. ¼ of Sec. 4, T. 22 S., R. 17 E., M. D. M.

7.9.18. *Oceanic Oil Company* (of Hanford; B. M. McCray, president) has a 950′ well in the N.W. ¼ of Sec. 1, T. 32 S., R. 17 E., M. D. M. Operations suspended.

7.9.19. *Stanislaus Oil Company* (of Modesto; J. Hewel, president) has a 600′ well in the N.W. ¼ of Sec. 4, T. 22 S., R. 17 E., M. D. M.

7.9.20. *Stockton Oil Company* (of Stockton, San Joaquin County) has a 670′ well in the N.W. ¼ of Sec. 30, T. 22 S., R. 18 E., M. D. M. Operations suspended.

CHAPTER 10.

THE COALINGA DISTRICT.

7.10.1. This district adjoins the Kreyenhagen district on the north. It embraces T. 21 S., R. 14 and 15 E.; T. 20 S., R. 13, 14, and 15 E.; T. 19 S., R. 13, 14, and 15 E., all in M. D. M.; also such portions of T. 21 S., R. 12 and 13 E.; T. 20 S., R. 12 E.; and T. 19 S., R. 12 E., M. D. M., as lie east of the western boundary of Fresno County. Except in one instance, all the development and prospect work in this district is north of the south branch of Los Gatos Creek, locally known as Alcalde Creek. In the Coalinga district oil-mining has been carried on in two fields: In the Oil City field, which lies to the north of the north fork of Los Gatos Creek, and in the Alcalde field, which lies between Alcalde Creek and the north fork of Los Gatos Creek.

7.10.2. The most important of these fields is the Oil City, about 9 miles north of Coalinga railroad depot on the S. P. R. R. (See Photo No. 32.) In this field the exposed formations range from the upper portion of the Middle Neocene to that of the Eocene or Tejon (Cretaceous B, according to the old nomenclature). A general idea as to the relation of these two formations may be gathered by an inspection of Fig. L (see atlas), which shows a ground plan of a portion of the territory, and of Fig. 14, which is a cross-section drawn through the Oil City field in a direction of S. 50° E. As therein shown, the lowermost formation consists of hard sandstone containing numerous concretions. This sandstone is overlain by dark-colored shales and sandstone containing Eocene fossils. Some of the strata of sandstone interbedded with the dark-colored shales yield an oil of low specific gravity, and have proved very productive. The shales and concretionary sandstone on which they rest are of Eocene (Tejon) age. Resting non-conformably on the Eocene rocks is a light-colored silicious shale, hereinbefore mentioned as belonging to the Lower Neocene series. Seepages of heavy, tar-like oil issue from this shale, and in some places form beds of asphaltum. In some of the wells in this vicinity an oil of 18° B., apparently from oil-sand in this formation, has been obtained. The only fossils found in the shales at Coalinga were *Pecten peckhami* (a Lower Neocene fossil), a few fish

PHOTO 31. McKittrick Oil-Field, Kern County.

PHOTO 32. Oil City, Fresno County

bones, and marine diatoms. The light-colored shale is very much contorted, and the exposed rocks for the most part stand at a greater angle than do the underlying or overlying rocks. Resting non-conformably on the light-colored shales (see Bulletin No. 3) is a series of sandstones and shales, sandstone predominating. This series contains numerous fossils, and represents the Middle Neocene formation. In most places it dips to the east of south at an angle of less than 25°. In this formation, immediately overlying the silicious shales, are strata of oil-sand, beds of gypsum which at one time were mined, and diatomaceous rocks impregnated with petroleum, the last named resembling the diatomaceous rocks seen at McKittrick, in Kern County. These rocks contain Miocene and Pliocene fossils. Higher up in the series are sandy formations containing beds of *Ostrea titan*, *Liropecten*, and *Tamiosoma*. Still higher up are dark-colored sands containing petrified wood. The upper portion of the Middle Neocene formations in this locality is characterized by a soft bluish sandstone and fine conglomerate containing fossils of Middle Neocene age. The soft bluish sandstone dips east of north at an angle of 10° to 15°.

7.10.3. The first well in the Oil City field was drilled about 1890. It was 163′ deep, penetrated dark-colored shale and soft sandstone, and yielded a little green oil and much gas. A windmill pump was attached to this well, and 20 bbls. of oil were pumped from it in two days. The third day it yielded 7 bbls.

In 1891–92 four wells were drilled by Messrs. Rowland & Lacy of Los Angeles. In one of these (a 4″ well), which was drilled to a depth of 400′, the formation penetrated is soft dark-colored shale and soft sandstone. This well was tested by pumping, and yielded about 9 bbls. of oil daily. The other wells were never pumped.

When the locality of which Oil City is now the center was visited by the writer in 1893, he found five wells—one a 4″ well in which an oil of low specific gravity stood within 32′ of the surface, and in which inflammable gas bubbled freely through the oil (see table of oil analyses, Part 2, Chapter 3); one a 4″ well, plugged; one a 7″ well, plugged; one a 10″ well, plugged; one a 14″ well, from which oil and water flowed and from which inflammable gas was rising. The last named well was burning fiercely, and a small stream of mineral water and oil flowed from the top of the casing.

In 1895, the Producers and Consumers Oil Company of Selma was organized by J. A. McClurg and others. They sunk a 695′ well and a 700′ well on Sec. 20, T. 19 S., R. 15 E., M. D. M., a short distance southeast of the wells of Rowland & Lacy. The two wells sunk by McClurg & Co. yielded 15 bbls. and 20 bbls. of oil a day respectively. The gravity of the oil was 34° B.

In 1896, Chanselor & Canfield commenced drilling in Sec. 17, T. 19 S.,

R. 15 E., M. D. M. They drilled two or three wells which were small producers. In this year (1896) Chanselor & Canfield leased the territory of the Producers and Consumers Oil Company in the N.W. ¼ of Sec. 20, T. 19 S., R. 15 E., M. D. M. They then drilled a well about 300′ east of the old wells, and struck oil-sand at a depth of 890′. This was a flowing well and yielded about 300 bbls. of oil a day.

In 1897, the Home Oil Company, of Selma, was organized by G. W. Terrill and others. This company drilled in the N.E. ¼ of Sec. 20, T. 19 S., R. 15 E., M. D. M. The wells drilled ranged from 900′ to 1700′ in depth, and were farther down the dip of the formation than other wells drilled in the Oil City field at that time. The third well drilled by this company is the Blue Goose, which is 1400′ deep; this well was completed in 1898, and is a flowing well, which is said to have produced from 500 to 1000 bbls. of oil a day. In August, 1900, it was stated that this well flowed at the rate of 250 bbls. in twenty-four hours.

In 1899, many other companies commenced operations in the Oil City field, but without success.

In 1900, the exploitations were carried on farther to the east. In the Middle Neocene formations overlying the silicious light-colored shales, some of these wells have proved very successful.

7.10.4. During the early development of the Oil City field, much inconvenience was experienced through lack of water. In 1899, J. A. McClurg sunk two 275′ wells in the valley land about 6 miles southwest of Oil City. The formation is: Drift to 200′; water gravel to 212′; tough clay to 275′. The water rose about 5′ in the casing. These wells yield an immense supply. Two 4″ steam pumps are being used to pump the water into the receiving tank. A duplex Dow pump, having a capacity of more than 15,000 gallons in twelve hours, forces the water through 6 miles of 3″ pipe to an elevation of 275′ above the top of the wells. The oil-field consumes about 15,000 bbls. of water every twenty-four hours. This is potable water, and rather hard.

7.10.5. The output of petroleum from the Oil City field during 1899 was 439,372 bbls. The oil is conveyed by pipe-line from Oil City to Ora Station on the S. P. R. R., a distance of 8½ miles. (See Pipe-lines.)

THE ALCALDE FIELD.

7.10.6. This field is about 3 miles southwest of Coalinga, and extends from the old coal mines, which are about 4 miles a little west of north from Coalinga, to Alcalde Creek. The petroleum claims on which prospect wells have been drilled are situated in the first two tiers of foothills which run in a southeasterly direction from the old coal mines. These foothills are for the most part formed of sandstone containing fossils of the Middle Neocene age. (See Bulletin No. 3, pp. 58–59.) It is conceded that these Neocene rocks lie non-conformably on the Eocene, although the dip of the two formations is about the same. No white

shale is seen between the Eocene and Middle Neocene formations in this locality, except a slight outcrop near the San Joaquin coal mine. In 1893 the writer obtained a small collection of fossils from the San Joaquin and California coal mines, which demonstrates that the formations of these mines are of the Eocene age (Cretaceous B, according to the old nomenclature). (See Bulletin No. 3, pp. 57–58.)

The outcropping rocks belonging to the Middle Neocene formations are principally sandstones with a little shale and conglomerate, the prevailing dip being about N. 70° E. Several brine and sulphur springs issue from this formation, and at one point there is a spring of tar-like oil. In 1893 the writer visited the San Joaquin coal mine (one of the coal mines in this locality) and saw a small quantity of oil of medium gravity bailed from one of the workings. There are no productive wells in the Alcalde district, but in August, 1900, ten prospect wells had been, or were being, drilled.

OIL CITY FIELD—PRODUCING WELLS.

Only such wells are mentioned as were producing in August, 1900.

7.10.7. *Coalinga Oil Company* (of Coalinga; C. A. Canfield, president) has fifteen wells in the N.W. ¼ of Sec. 20, and four wells on the S. ½ of Sec. 17, T. 19 S., R. 15 E., M. D. M. The wells on Sec. 20 range from 300′ to 1450′ in depth, and produce from 1 to 200 bbls. of oil a day. The formation is blue shale until oil-sand is struck at the bottom of the well. The oil-sand ranges from 2′ to 80′ in thickness. The wells on Sec. 17 range from 300′ to 600′ in depth, and it is said that they appear to be near the edge of oil-sand. They are small producers. The oil obtained from the wells on Secs. 17 and 20 has a gravity of about 33.3° B.

7.10.8. *Home Oil Company* (of San Francisco; R. A. Clark, president) has five wells, varying in depth from 1100′ to 1680′. The formation is dark-colored shale and oil-sand. These wells yield from 20 to 250 bbls. of oil a day. Specific gravity of oil, 33.3° B. No. 3 of this group is the original Blue Goose well, which has proved such a bonanza. In August, 1900, this company was drilling two new wells, which were then 500′ and 1200′ deep, respectively.

7.10.9. *Independence Oil Company* (of Fresno) has three wells, varying in depth from 800′ to 1000′, in the S.W. ¼ of the N.E. ¼ of Sec. 28, T. 19 S., R. 15 E., M. D. M. Formation, shale and sandstone. These wells are said to yield more than 5 bbls. a day each. Gravity of oil, 22° B. This is a brown oil.

7.10.10. *Oil City Petroleum Company* (J. T. G. Hart, president) has a 450′ well in the W. ½ of the N.W. ¼ of Sec. 28, T. 19 S., R. 15 E., M. D. M., and three wells in the S.E. ¼ of the same section. These wells range from 800′ to 950′ in depth. They yield about 40 bbls. of oil a day. Specific gravity of oil, about 22° B. The formation is sandstone and shale.

7.10.11. *Phœnix Oil Company* (of Hanford; P. McRae, president) has a 330′ well and a 560′ well in the S.E. ¼ of Sec. 20, T. 19 S., R. 15 E., M. D. M. The formation in the deeper of these wells is as follows: Pink shale to 300′; sand with water to 330′; dark-colored shale to 420′; sand, with sulphur, water, and oil, to 440′; dark-colored shale to 500′; white clay-shale to 520′; oil-sand to 535′; shale to 540′; white shale to 560′; oil-sand to 575′. It is said that this well yields 50 bbls. of oil a day. Specific gravity, 18° B. In the shallower well the oil-sand was struck at a less depth, but the well yields only 25 bbls. of oil a day. Specific gravity of the oil is 14° B.

7.10.12. *Twenty-eight Oil Company* (of Hanford) has a 1000′ well in the N.E. ¼ of Sec. 28, T. 19 S., R. 15 E., M. D. M. It is said that this well yields about 50 bbls. of oil a day. Gravity of oil, 22° B. This is a brown oil. Formation, shale and soft sandstone.

OIL CITY FIELD—PROSPECT WELLS.

7.10.13. *Ætna Oil Company* (of San Francisco) has a 900′ well in the N.E. ¼ of Sec. 31, T. 19 S., R. 15 E., M. D. M. Formation, mostly shale. Abandoned.

7.10.14. *Blue Goose Oil Company* (of San Francisco; W. H. Gray, manager) has a 1600′ well in the E. ½ of the N.E. ¼ of Sec. 20, T. 19 S., R. 15 E., M. D. M. Formation, dark-colored shale. Drilling.

7.10.15. *Bonanza King Oil Company* (of San Francisco ; Mr. Hotaling, president) has a 1300′ well in the S.W. ¼ of Sec. 10, T. 19 S., R. 15 E., M. D. M. Formation, shale and water-sand.

7.10.16. *California Oil and Gas Company* (of Coalinga; W. Graham, president) has a well in the S.E. ¼ of Sec. 19, T. 19 S., R. 15 E., M. D. M. Formation, principally shale. This company has also a well in the S.W. ¼ of Sec. 20. Abandoned.

7.10.17. *Caribou Oil Company* (of Hanford; C. C. Spinks, president) has a well in the S.W. ¼ of Sec. 22, T. 19 S., R. 15 E., M. D. M. Formation, dark-colored shale and oil-sand.

7.10.18. *Carmelita Oil Company* has commenced drilling in the W. ½ of the E. ½ of Sec. 3, T. 20 S., R. 15 E., M. D. M.

7.10.19. *Confidence Oil Company* (of Fresno; F. Clarey of Coalinga, manager) has a 900′ well in the S.E. ¼ of Sec. 25, T. 19 S., R. 4 E., M. D. M. Formation, dark-colored shale. Drilling tools lost in the well. Abandoned. This company has also a 300′ well in the N.W. ¼ of Sec. 31, T. 19 S., R. 15 E., M. D. M.

7.10.20. *Crescent Oil Company* has a 900′ well in the S.E. ¼ of Sec. 20, T. 19 S., R. 15 E., M. D. M. Formation, light-colored shale. Abandoned.

7.10.21. *Elk Oil Company* (of Hanford; E. E. Bush, president) has a 500′ well in the N.E. ¼ of Sec. 22, T. 19 S., R. 15 E., M. D. M. Formation, shale and much water.

7.10.22. *Great Western Oil Company* (G. W. McNear, president) has an 1150′ well in the S.W. ¼ of Sec. 26, T. 19 S., R. 15 E., M. D. M. Formation, shale and sandstone, with much water.

7.10.23. *Independent Oil Company* has a 1580′ well on the N.E. ¼ of Sec. 17, T. 19 S., R. 15 E., M. D. M. Formation, dark-colored shale and sandstone, flowing water, and a little oil. Abandoned.

7.10.24. *Investment Oil Company* (of San Francisco; E. B. Pond, president) has an 1800′ well in the S.E. ½ of Sec. 16, T. 19 S., R. 15 E., M. D. M. Formation, dark-colored shale. Drilling.

7.10.25. *Minnesota Oil Company* (of Fresno, Cal., and Duluth, Minn.; J. A. McClurg, president) has a 600′ well in the N.E. ¼ of Sec. 23, T. 19 S., R. 15 E., M. D. M. Formation, sandstone and blue shale. Drilling.

7.10.26. *Montjack Oil Company* (of Hanford; E. E. Bush, president) has a 500′ well in the N.W. ¼ of Sec. 22, T. 19 S., R. 15 E., M. D. M. Tools lost. Not completed.

7.10.27. *Mutual Oil Company* has an 1800′ well in the S.E. ¼ of Sec. 20, T. 19 S., R. 15 E., M. D. M. Abandoned.

7.10.28. *New York Oil Company* (of Coalinga; L. L. Cory, president) has a 2080′ well in the S.W. ¼ of Sec. 20, T. 19 S., R. 15 E., M. D. M. Formation, shale.

7.10.29. *Old Keystone Oil Company* (of Santa Paula, Ventura County; Lyman Stewart, president) has an 1150′ well on the S.E. ¼ of Sec. 8, T. 19 S., R. 15 E., M. D. M. Formation, dark-colored shale, with small quantity of oil. Abandoned. This company has also a 1200′ well on Sec. 4, T. 19 S., R. 15 E., M. D. M. Drilling.

7.10.30. *Rock Oil Company* has a 700′ well in the S.W. ¼ of Sec. 28, T. 19 S., R. 15 E., M. D. M. Formation, shale and sandstone. Drilling.

7.10.31. *Santa Clara Oil Company* has a 900′ well in a fraction on the west side of Sec. 30, T. 19 S., R. 15 E., M. D. M. Abandoned on account of water.

7.10.32. *The Selma Oil Company* (J. A. McClurg, president) has an 1888′ well in the S.E. ¼ of Sec. 20, T. 19 S., R. 15 E., M. D. M. Formation: Sandstone to 340′, then dark-colored shale to within 70′ of the bottom of the well, at which depth oil-sand was struck. Abandoned.

7.10.33. *Wisconsin Oil Company* (of Superior, Wisconsin; J. M. Smith, president) has a 400′ well in the N.E. ¼ of Sec. 32, T. 19 S., R. 15 E., M. D. M. Formation, principally sandstone. Drilling.

ALCALDE OIL FIELD—PROSPECT WELLS.

The following records were obtained in August, 1900:

7.10.34. *Badger State Oil Company* (of Duluth, Minn.; P. G. Hart of Fresno, president) has a 700′ well near the center of Sec. 1, T. 21 S., R. 14 E., M. D. M. The formation is similar to that noted at the Sunnyside wells. This well was abandoned on account of water and running sand.

7.10.35. *Hawkeye State Oil Company* (of Los Angeles) has two wells in Sec. 6. One of these is 500′ deep, and is being drilled still deeper. It is said that oil-sand has been struck in one of the wells; the other well is abandoned.

7.10.36. *May Brothers* (of Coalinga, Fresno County) have a 970′ well in the S.E. ¼ of Sec. 14, T. 20 S., R. 14 E., M. D. M. The formation is blue shale. At 900′ a small quantity of light oil was struck in a thin stratum of oil-sand. Abandoned.

7.10.37. *Rommel & Westlake Oil Company* (of Los Angeles) has a well in the N.E. ¼ of Sec. 2, T. 21 S., R. 14 E., M. D. M. Work suspended.

7.10.38. *Star Oil Company* (of San Francisco; G. W. Terrill, president) has a 650′ well in the N.W. ¼ of Sec. 34, T. 19 S., R. 15 E., M. D. M. Formation, principally blue shale.

7.10.39. *Sunnyside Oil Company* (of West Virginia; J. A. McClurg of Coalinga, president) has a 654′ well in the S.E. ¼ of Sec. 35, T. 20 S., R. 14 E., M. D. M. Formation: Sandstone to 40′; dark-colored shale, with oil, to 75′; oil-sand to 110′ (this oil had a specific gravity of 25° B.); then a stratum of hard sandstone, and a thick stratum of running sand with good water to 654′. This company has also a 256′ well and a 312′ well in the N.W. ¼ of Sec. 1, T. 21 S., R. 14 E., M. D. M. In these wells a formation similar to that noted in the well in Sec. 35 was penetrated, but the oil-sand was struck at a depth of 256′ and 312′, respectively. The oil-sand was penetrated for about 20′. It is said that these wells would produce about 3 bbls. of green oil a day, which has a specific gravity of 24° B.

7.10.40. *Wright Association* (of Downey, Los Angeles County; W. W. Wright, president) has a 900′ well in the N.W. ¼ of Sec. 26, T. 20 S., R. 14 E., M. D. M. This well is about 200′ north of the Whittier & Green well. It was abandoned on account of water.

WARTHAM CREEK FIELD.

7.10.41. *Venus Oil Company* (of San Francisco; J. Greenbaum, president) has an 850′ well in the N.W. ¼ of Sec. 5, T. 22 S., R. 14 W., M. D. M. Formation, slaty shale, with traces of oil of high specific gravity. Drilling.

7.10.42. *Wale Oil Company* (of Los Angeles) has a 700′ well in Sec. 4, T. 22 S., R. 14 E., M. D. M. Some oil was struck, but the well was abandoned on account of water and quicksand.

PART 8.

MONTEREY, SAN LUIS OBISPO, AND SAN BENITO COUNTIES.

CHAPTER 1.

MONTEREY COUNTY.

THE OIL-YIELDING FORMATIONS.

By H. W. Fairbanks, Ph.D.

8.1.1. The geological conditions of Monterey County with reference to oil are in many respects quite similar to those of San Luis Obispo County, which adjoins it on the south. (See San Luis Obispo County.) The same formations that are found in the latter county extend northwesterly into Monterey. In recent months much attention has been given to the oil-producing shales of this county, particularly in that region lying along the western side of the Salinas Valley, and in the southeastern portion occupied by the Cholame Valley. The following notes will deal particularly with the western portion of the county.

In the western part of the county the oil-yielding formations are confined to the strip of territory lying between the summit of the Santa Lucia range and the Salinas River. These formations probably extend under the Salinas Valley in the direction of Cholame, but are separated from that valley by a low ridge of older rocks. At the southern edge of the county the flinty organic shales of the oil-producing formation form low hills, through which the San Antonio River flows to join the Salinas. As we continue northward between the San Antonio and the Salinas rivers we find a broad zone of low hills called the San Antonio Hills. These hills, as well as the region occupied by the San Antonio Valley, are formed of the same oil-producing shales. North and northwest of Jolon these rocks rise to form the more rugged mountains grouped about Santa Lucia Peak. A broad reach of mountainous country formed of the shales extends northerly to the valley of the Arroyo Seco and thence over a low divide to the headwaters of the Carmelo River. In the latter region the shales form a long trough inclosed between the Santa Lucia range and the Soledad Hills. The shales continue almost unbroken down the valley of the Carmelo River to the ocean. The writer is not aware that any oil has been found in this region.

Although the oil-producing rocks are thus seen to be very extensive in Monterey County, indications of the presence of oil are not as prominent as farther south. There are, however, a number of promising localities. At the point where the San Antonio River cuts through the hills to join the Salinas, there is an extensive bed of oil-sand or bituminous rock. This may be traced for about a mile, and is fully 200′ thick in places. The oil, as it issued from the shales, has here been preserved in a bed of sandstone at the base of the San Pablo formation. The extent of the latter formation and the presence of porous sandstones at its base condition, in large measure, the extent and value of the oil-deposits of this section, as is the case in San Luis Obispo County. Farther north, along the eastern slope of the San Antonio Hills, in the vicinity of San Lucas, other indications are reported, and it is these that form the basis of the drilling now going on in the latter region. Seepages are also reported from one of the southern branches of the Arroyo Seco.

Six miles west of Bradley a well is now being drilled with the expectation of testing a portion of the oil-sands first described. Near San Lucas, one well has been drilled with negative results.

In selecting locations for wells in this region, the greatest care should be exercised in studying the peculiarities of the formations present. It should be recognized that the oil-sands are not a part of the flinty shales, the oil-producing formation, but that they lie at the base of a younger formation overlying the former. Faulting and folding have affected this younger formation, and these conditions must be taken into account. Wells drilled in the flinty shales are doomed to be dry.

THE PARKFIELD DISTRICT.

By W. L. Watts.

8.1.2. The Parkfield district embraces T. 23 S., R. 13 E., and that portion of T. 22 S., R. 14 E., M. D. M., which lies west of the Fresno County line. In this district the greatest interest has been centered in the Little Cholame Valley. On the east side of this valley the main ridge of the Coast Ranges rises to an elevation of nearly 4000′. The axial rocks of this ridge are granite. In some places the granite is overlain by metamorphic sedimentary formations, and in others by unaltered Tertiary rocks. In the Parkfield district the Tertiary system is well represented. In Stone's Cañon are coal-bearing rocks, presumably of Eocene age. At several places in the Little Cholame Valley, silicious shales, characteristic of the Lower Neocene series, are found; they are also met with higher up on the mountain range, where they rest on the granite. In by far the greater portion of Cholame Valley the exposed rocks are shales and sandstones belonging to the Middle Neocene series. At several places in the Little Cholame Valley there are seepages of petroleum issuing from rocks belonging to the Middle Neocene series, and strata

of oil-sand are exposed. At one point on the Big Sandy Creek oil of low specific gravity issues from a narrow strip of sedimentary rocks. Toward the north, these unaltered sedimentary formations are in contact with a bed of metamorphic sedimentary rocks and serpentine, and toward the south with granite; the latter is for the most part covered with sedimentary formations, probably of Neocene age. The granitic rocks form the axis of a fold which extends through the upper portion of the Big Sandy and Cholame creeks. In most places where the granitic rocks crop out, they are much decomposed and might easily be mistaken for sandstone. In September, 1900, the following companies were operating in the Parkfield district:

8.1.3. *Cholame Valley Oil and Development Company* (Captain Frank Barrett of Palo Alto, manager) has four wells in Sec. 31, T. 22 S., R. 14 E., and Sec. 5, T. 23 S., R. 14 E., M. D. M. One well was drilled 950′ through shale, rotten sand, and granite; a small amount of oil (gravity, 20° B.) was struck at a depth of 130′. The three other wells in like formation had a depth of 800′, 200′, and 200′, respectively. Abandoned.

8.1.4. *Parkfield Oil Company* (Captain Frank Barrett of Palo Alto, manager) has a well about 100′ deep in Sec. 16, T. 23 S., R. 14 E., M. D. M. Abandoned.

8.1.5. *Waverly Oil Company* (Charles King of Hanford, president) has a well in Sec. 32, T. 22 S., R. 14 E., M. D. M. At 350′ sand and a little gas were encountered; at 700′ and 800′ from 18″ to 2′ of lime "shells" were penetrated; below that depth the formation is black shale. This well is 1100′ distant from the croppings of light-gray sand, and 1700′ east of a granite ledge which has a strike of west of north.

THE SAN ARDO DISTRICT.

8.1.6. This district includes that portion of the drainage basin of the Salinas River and its tributaries which lies between the 5th and 6th standard lines south of Mount Diablo. In September, 1900, the following companies were operating in this district:

8.1.7. *Tomboy Oil and Improvement Company* (of San Francisco) has one well in Sec. 19, T. 22 S., R. 10 E., M. D. M.

8.1.8. *San Antonio Oil Company* (Seth Mann of San Francisco, president). In October, 1900, this company was drilling on lands in Secs. 20, 29, and 30, T. 22 S., R. 10 E., M. D. M., on the west side of the Salinas River about 2 miles southwest of the town of San Ardo.

8.1.9. *San Ardo Consolidated Oil Company* (G. W. Fletcher of San Francisco, president). The territory of this company is in San Ardo district, in Sec. 12, T. 22 S., R. 9 E., M. D. M., and Sec. 7, T. 22 S., R. 10 E., M. D. M. One well; formation, soil to 50′; water-sand to 100′; sandy shale to 200′; coarse gray sand, gravel and bowlders, and sandy shale

interbedded with oil-sand to 450′; hard shells and shale to 500′; oil was struck between the depths of 560′ and 630′; below that depth the formation is oil-sand and shale to 846′.

CHAPTER 2.

SAN LUIS OBISPO COUNTY.

THE OIL-YIELDING FORMATIONS.

By H. W. Fairbanks, Ph.D.

8.2.1. That portion of the Coast Ranges embraced within the boundary of San Luis Obispo County is characterized particularly by extensive deposits of bituminous rock. There are also to be found numerous springs of a thick, tar-like oil. Under some circumstances the oil from these springs has impregnated sandstones forming bituminous rock; under others it has accumulated in great quantities on the surface, as in the valley of Tar Spring Creek. The source of the oil is to be found in a formation which once covered nearly the whole of the area of the county, but which has now been in a great measure removed by erosion. This oil-producing formation belongs to the lower part of the Middle Tertiary period, and is known as the Monterey formation. It is composed of sandstones, limestones, clays, and hard silicious shales. Investigation has shown that the limestones and silicious shales are the source of the oil and other bituminous products. The rocks are in a great part of organic origin, having been formed of the skeletons of fish and microscopic sea organisms. In some places the oil-producing rocks are nearly a mile in thickness.

Through a long-continued process of distillation brought about through the influences of pressure and heat, the organic matter has been driven off and in places preserved. Conditions for its preservation are in part furnished by porous rocks, such as sandstones and sandy shales. The oil-producing formation is at present found forming the main portion of the San Luis range, extending from Point Buchon southeasterly past Arroyo Grande and toward the Sisquoc. That portion of the Santa Lucia range lying east of Cuesta Pass is also formed of the same shales. Another belt runs northwesterly past Santa Margarita and down the Salinas Valley. These rocks swing around the northern edge of the low granite mountains lying east of the Salinas River, and undoubtedly underlie the Estrella region. Going south toward La Panza, upon the northeastern side of the San José Mountains, extensive outcrops of these rocks appear. They dip easterly under the valley of the San Juan, and there is every reason to suppose that these oil-producing shales underlie much of the Carissa Plains and the Temblor range, separating these

plains from the San Joaquin Valley. They thus appear to connect with the oil-producing regions of Kern County. It must be borne clearly in mind in exploiting for oil that this oil-producing formation, whose extent has just been described, is not necessarily the best one in which to drill wells. Although the thick oil is distinctly seen issuing from this formation in springs in the San Luis and Santa Lucia ranges, yet it can only be found gathered in commercial quantities in those rocks which are of a nature sufficiently porous to permit of its absorption. On Tar Spring Creek, as well as on the Huasna River, heavy beds of sandstone are associated with the oil-producing shales as a part of the same formation, and it would seem that conditions might be favorable in this region for oil-wells in the oil-producing formation; but in other parts of the county oil can be found only where another and younger formation occurs overlying the oil-shales. It is to this younger formation that we owe the presence of the great deposits of bituminous rock in the vicinity of Edna, where this formation consists essentially of porous sandstones. The formation is termed the San Pablo, and belongs to the upper division of the Middle Tertiary. The San Pablo formation forms an elongated basin-like syncline reaching from a point on the Marie ranch about 1 mile northwest of Sycamore Springs southeasterly to Arroyo Grande Creek. The base of this formation, resting directly upon the oil-producing shales, is almost everywhere filled with an oil now so thickened that it constitutes the bituminous rock of commerce. Upon the Marie ranch along the ocean cliffs southeast of Mallagh Landing, and in the vicinity of Edna, the outcrops of bituminous rocks are particularly prominent. In the past years, quite a number of wells have been drilled in San Luis Obispo County, but the most of these have been so poorly located that, as yet, we cannot assert that this field has been fairly prospected. That vast quantities of oil have been formed here is certain; that it is forming to-day through chemical action and heat is equally certain, but as to whether it will be found in quantity in a thin condition, we have as yet no definite evidence. It may be that in this region the oil has a greater proportion of permanent base than in other sections. More investigations, however, are required to settle the matter.

In drilling wells, it is very important to pay attention to the geological conditions. Those locations must be selected where the geological structure indicates that the proper rocks will be penetrated by the drill. Much useless work has been done in this section because of the lack of precaution in this regard. It is certain that the supply of bituminous rock in the southern part of the county is very great, and further exploitation may show oil thin enough to pump. Indications are certainly favorable. In the northeastern part of the county there is a vast field underlain by the oil-producing rocks which is worthy of practical

investigation. It is as yet too little known for one to say anything about the depth at which these rocks would be encountered.

RECORD OF WELLS.

By Geo. A. Tweedy, C.E.

8.2.2. In this county there is as great a showing of bituminized formations as in any other county in the State. There are extensive beds of bituminous rock which have yielded a large amount of paving material, and some attempts have been made to mine and refine the asphaltum which occurs as superficial deposits. During the last twelve years, several prospect wells have been drilled for oil, and in September, 1900, the following companies were operating in San Luis Obispo County:

8.2.3. *Huasna Development Company* (of Alcatraz Landing, Santa Barbara County) has two wells in the Huasna district about 15 miles east of Arroyo Grande. One of these wells is in T. 32 S., R. 15 E., M. D. M., and is said to be 841′ deep. Abandoned. The other is in Sec. 23, T. 32 S., R. 15 E., M. D. M. In October, 1900, this well was said to be 210′ deep. Drilling.

8.2.4. *San Luis Obispo Petroleum Company* has one well on the Tar Spring ranch in T. 32 S., R. 14 E., M. D. M. This well is said to be 900′ deep. Abandoned.

8.2.5. *Union Oil Company* has three wells near Arroyo Grande. In these wells only traces of oil were obtained. This company is drilling a fourth well in the same locality.

CHAPTER 3.

SAN BENITO COUNTY.

8.3.1. In San Benito County there are oil-yielding formations in the Big Panoche, Little Panoche, and the Hollister districts.

BIG PANOCHE DISTRICT.

8.3.2. This district includes the drainage basin of the Big Panoche Creek and its tributaries. By far the greater portion of the district lies within the confines of San Benito County. The companies that have drilled or are drilling in the Big Panoche district are as follows:

8.3.3. *Ashurst Oil Company* (Jacob Simon of Stockton, president). This company began operations in October, 1900, in Sec. 31, T. 16 S., R. 11 E., M. D. M., on the lands of Robert Ashurst, 2 miles south of the Union Oil Company's lands.

8.3.4. *Dewey Oil Company* (W. Crawford of Hanford, president). A 16′ shaft sunk by this company on Sec. 8, T. 17 S., R. 11 E., M. D. M. struck a strong seepage of oil.

8.3.5. *Dos Palos Oil Company* (M. Christian of Dos Palos, president)

has a well in Sec. 8, T. 15 S., R. 11 E., M. D. M. Drilled, with hydraulic rig, 400′ through shale and sandstone. A small quantity of oil was struck.

8.3.6. *Esmeralda Oil and Development Company* (H. S. Field of San Francisco, president) has a well in Sec. 13, T. 15 S., R. 10 E., M. D. M. Hand-drilled 32′, through shale; struck sand stratum with a little oil. This company was also preparing to drill in Sec. 26, T. 17 S., R. 11 E., M. D. M.

8.3.7. *Fresno Alpha Oil Company* (Gen. J. M. Gleaves of San Francisco, president) has a well in T. 16 S., R. 12 E., M. D. M., on Silver Creek. This well was drilled to a depth of 325′, and struck a strong flow of gas. Between the depths of 95′ and 268′, a 35′ and a 33′ stratum of oil-sand were struck; at 300′ a heavy flow of water was encountered. This company has made a preliminary survey for a railroad line to Mendota.

8.3.8. *Hamiltonian Oil Company* (N. C. Briggs of Hollister, president) has sunk a shaft 14′ deep in Sec. 24, T. 17 S., R. 11 E., M. D. M A 2′ stratum of oil-sand was struck. Still prospecting.

8.3.9. *Ingomar Oil Company* (M. H. de Young of San Francisco, president) has a well in Sec. 8, T. 15 S., R. 11 E., M. D. M. Hand-drilled 17′ through shale and sand.

8.3.10. *McCoy Oil Company* (R. Irwin of Fresno, president) has sunk several shafts from 6′ to 16′ deep in Sec. 9, T. 17 S., R. 11 E., M. D. M. Some oil struck.

8.3.11. *Olympia Oil Company* (John Hammerschmidt of San Francisco, president) has sunk a shaft 46′ deep in Sec. 10, T. 15 S., R. 11 E., M. D. M.

8.3.12. *San Benito Oil Company.* During the summer of 1900, this company prospected in Secs. 24 and 36, T. 16 S., R. 10 E.; Sec. 1, T. 17 S., R. 10 E.; Sec. 7, T. 17 S., R. 11 E., M. D. M. (lands of J. C. Barg); and in Sec. 6, T. 17 S., R. 11 E., M. D. M. (lands of Thomas Flint, Jr., and Mark Ashurst), 65 miles southeast of Hollister.

8.3.13. *San Carlos Oil Company* has a well in Sec. 8, T. 17 S., R. 11 E., M. D. M. Seven years ago a 105′ well was drilled by hand, and some oil struck. No work has been done since, owing to litigation.

8.3.14. *Santa Maria Oil Company* (Charles T. Behan of San Francisco, president) has sunk a 40′ shaft in Sec. 21, T. 17 S., R. 11 E., M. D. M. Formation, principally sandstone. Some oil was struck.

8.3.15. *Silver Creek Oil Company* (George W. Schmidt of Fresno, president) has a well in Sec. 33, T. 15 S., R. 12 E., M. D. M., on Silver Creek 15 miles south of Panoche store. Drilled 800′ through sand and shale.

8.3.16. *Union Oil Company* (Lyman Stewart of Santa Paula, president) has drilled five wells, varying in depth from 700′ to 1200′ in Sec. 24, T. 16 S., R. 10 E., and Sec. 19, T. 16 S., R. 11 E., M. D. M. Three

of these wells produced 30 to 40 bbls. per day; oil, 34° B. These three wells were capped. The two others were abandoned and the casings drawn.

THE LITTLE PANOCHE DISTRICT.

8.3.17. This district includes the drainage basin of the Little Panoche Creek and its tributaries. The greater portion of the district is in Fresno County. In October, 1900, the following companies were operating or had been operating in this district:

8.3.18. *Big Panoche Oil Company* has a well 700′ deep in Sec. 23, T. 13 S., R. 11 E., M. D. M. Casings drawn and well abandoned.

8.3.19. *Old Glory Oil Company* (in Merced County?). One well drilled 530′ and abandoned.

8.3.20. *Pacific Oil and Development Company* (of Los Baños) has a well in T. 13 S., R. 9 E., M. D. M. Drilled 400′. At a depth of 280′ some oil was struck.

8.3.21. *Panichito Oil Company* (D. M. Lloyd of Oakland, president) has a well in Sec. 20, T. 14 S., R. 11 E., M. D. M. Drilled 350′ through shale and sandstone. Some oil was struck.

8.3.22. *World Oil Company* (J. T. Riley of San José, president) has drilled one well in Sec. 31, T. 14 S., R. 10 E., M. D. M., 500′ through shale and sand, encountering a body of salt water.

THE HOLLISTER DISTRICT.

8.3.23. This district includes the drainage basin of the San Benito River and its tributaries. In October, 1900, the following companies were operating or had been operating in this district:

8.3.24. *Hollister Crude Oil Company* (Ltd.) (C. J. Tallon of San Francisco, president; E. J. Bean, resident superintendent). This company has sunk a 68′ shaft on lands leased from R. W. Chappel in San Justo grant, Lot 14, 4 miles southeast of Hollister. The formation is black shale, with a strong odor of oil. In October, 1900, a derrick had been erected preparatory to drilling.

8.3.25. *Nonpareil Consolidated Oil Company* (of San Francisco; E. C. Newell, manager) has a 1030′ well in Sec. 32, T. 18 S., R. 10 E., M. D. M., on the Alvarez ranch near Bitterwater Creek. Formation, blue shale and some hard shells, with traces of oil. Drilling. This company has also three test wells, 68′, 89′, and 97′ deep, respectively. The owners state that oil was struck in all the test wells.

8.3.26. *San Benito County Oil Company* (R. P. Lathrop of Hollister, president; E. J. Bean, superintendent). This company is operating on 170 acres of land leased from John Kehl, 5 miles southeast of Hollister, in Sec. 24, T. 13 S., R. 5 E., M. D. M. In the middle of October, 1900, one well had been drilled to a depth of 425′. Formation: Black shale to 220′; oil-sand to 267′; blue shale to 285′ (at this depth gas and warm salt water were struck); blue shale to 425′.

PART 9.

ALAMEDA, SANTA CLARA, SAN MATEO, AND CONTRA COSTA COUNTIES.

CHAPTER 1.

ALAMEDA COUNTY.

9.1.1. Oil-yielding formations crop out in many places in Alameda County, and as early as 1875 attracted the attention of the oil-prospector. Since that date, several comparatively shallow wells have been sunk, principally in the vicinity of Livermore.

9.1.2. *The Alameda Oil Company* (of San Francisco) has a well in Sec. 22, T. 2 S., R. 2 E., M. D. M., at a point about 4 miles north of Livermore. In July, 1900, this well was 1175′ deep. The formation is principally sandstone. The well yields much gas and salt water, with some traces of oil.

CHAPTER 2.

SANTA CLARA COUNTY.

9.2.1. The existence of petroleum-yielding formations in Santa Clara County has been known for many years, notably at Moody Gulch and at the Sargent ranch near the western boundary of the county. At the first-mentioned locality an oil-field was developed by Mr. R. C. McPherson, the first well being drilled in 1878–79. This field has been a productive one until the present time. It is now owned by the Golden Gate Oil and Development Company. On the Sargent ranch there are extensive superficial deposits of asphaltum, and tar-springs ooze not only from sedimentary formations, but also from serpentine. In 1890 a well was sunk on the Sargent ranch, but only a small quantity of tar-like oil was obtained. A large portion of the Sargent ranch and adjacent territory is leased by the Watsonville Oil Company, as hereinafter noted.

9.2.2. The geological formations seen by the writer on the territory of the Watsonville Oil Company consist of:

(1) Silicious shales, which resemble the silicious shales of the Lower Neocene series. These shales are inclined at a great angle, and yield a heavy, tar-like oil, which forms superficial beds of asphaltum.

(2) A formation, consisting principally of sandstone, which appears to rest non-conformably on the silicious shales; in places the sandstone is bituminous.

A small portion of the territory owned by the Watsonville Oil Company is in Santa Cruz County.

9.2.3. Output of petroleum in Santa Clara County for three years ending 1899:

	Bbls.	Value.
1897	4,000	$10,000 00
1898	3,000	6,000 00
1899	1,500	3,000 00
Total for three years	8,500	$19,000 00

PRODUCTIVE OIL-WELLS.

Only those wells are mentioned which were producing in July, 1900.

9.2.4. *Golden Gate Oil and Development Company* (of San Francisco; Frank A. Garbutt, president). This company succeeded A. McPherson. The wells, numbering some fourteen, are situated in Moody Gulch, 2 miles west of Alma, in Secs. 8 and 17, T. 9 S., R. 1 W., M. D. M. The company began operations in March, 1900, re-opening two of the old wells, one at an elevation of 1225′, the other at 1050′. The upper well, which was down 700′, was deepened to 1150′, through black shale for the greater depth, and through a white pebbled sand near the bottom. A small amount of oil (about 1 bbl. per day) was struck at 900′. The lower well was sunk 900′ by the former operators, and the present company had derrick, engine, and boiler on the ground in July to continue drilling. A third well, which was drilled to a depth of about 1200′ by former operators, contains oil that stands about 15′ below the collar of the well. The oil has a gravity of 39° B. The formation has a strike of west of north, and dips to the west. Steam power is used, with wood for fuel. Until 1900 these wells were the only productive wells in Santa Clara County; in that year they produced 1500 bbls of oil.

9.2.5. *Watsonville Oil Company* (of Watsonville; F. A. Kilburn, president) has under lease 7235 acres, including 3269 acres of the J. P. Sargent tract, 1200 acres of the Santa Clara Land and Lumber Company tract, and 1845 acres of the Casserly tract. The Sargent lands, on which the Watsonville Oil Company operates, occupy Sec. 31 and a portion of Sec. 32, T. 11 S., R. 4 E.; Secs. 5 and 6, T. 12 S., R. 4 E.; Sec. 1 and a portion of Sec. 2, T. 12 S., R. 3 E.; and Secs. 35 and 36, T. 11 S., R. 3 E—all in M. D. M. There is also included in these lands two strips adjoining the Sargent lands on the north, containing respectively 433 and

488 acres. The Santa Clara tract and the Casserly tract lie to the north and northwest. The operations include seven wells. Well No. 7 was started in September, 1900, and in the middle of that month was down about 300′. Wells Nos. 5 and 6 were sunk 670′ and 980′. In the spring and summer of 1900, No. 5 was producing about 5 bbls. a day, the oil finding a market at Gilroy and Hollister, where it is used for fuel; it is also used for fuel by the company operating the wells. In July last, it was decided to abandon well No. 6, for only traces of oil had been found in it, but when the casing was drawn, oil began to flow into the well. Well No. 7 was then commenced within 300′ of Nos. 5 and 6. The wells of the Watsonville Oil Company are 2 miles distant from a shipping point on the S. P. R. R.

PROSPECT WELLS.

Information obtained by L. H. Eddy.

Only those wells are mentioned which had been drilled, or were being drilled, in August, 1900.

9.2.6. *Alma Oil Company* (of San José; M. G. Rhodes, president) has a well 4 miles south of Alma, in T. 9 S., R. 1 W. The company owns 20 acres on Los Gatos Creek. Drilling was commenced in July, 1900. The well is situated at an elevation of 1425′, on a yellow sandstone belt which has a course of east of north. It is within half a mile of the Santa Cruz narrow-gauge branch of the S. P. R. R., 2½ miles from Wrights, and 60 miles from San Francisco. Steam power is used. There is a plentiful supply of wood and water.

9.2.7. *Gilroy Oil and Development Company* (of Gilroy, recently incorporated). This company has bonded 1000 acres of land on Uvas and Arthur creeks, in Solis district, 4½ miles west of Gilroy. The surface formation is sandstone. There are oil-seepages within 200 yards of the well.

9.2.8. *Kreyenhagen Land and Oil Company* (of Los Angeles; John A. Hendrickson, president) has leased from the Watsonville Oil Company 250 acres in Sec. 32, T. 11 S., R. 4 E., M. D. M. In September, 1900, this company was preparing to drill.

9.2.9. *Main Estate* (oil-wells on). The following records of wells drilled on the Main Estate, 7½ miles south of San José, were given the writer by R. C. McPherson, of Santa Clara County:

Well No. 1: Coarse gravel to 30′; sand and clay to 50′; slate to 83′; brown shale and gas to 134′ (gas burned at top of well); sand, with oil, to 160′; hard shale (gas) to 170′; soft shale and a little sand, with oil, to 180′; hard, dark shale, with oil, to 212′; granitic rock and shale to 260′; black shale and oil to 285′; hard shells to 290′; shale, with oil, to 300′; shelly formation, with some oil, to 215′; dark shale to 340′; lime rock to 390′; brown shale to 400′; sandy shale to 410′; slate and iron pyrites to 415′; hard gray sand and gas to 422′; shale to 462′; slate and

streaks of hard, shelly rock to 498′; shale to 504′; cavey formation to 508′; sandy shale, with strong flow of gas, to 513′; slate to 541′; soap rock to 565′; slate to 580′; sand rock to 590′; sand and shale, with more gas, to 620′; slate to 629′; very soft slate to 666′; hard streaks of slate to 680′; bottom of well in slate to 754′. The well was cased with 10″, 8″, and 6″ casing. Drilled in 1892.

Well No. 2: Gravel to 25′; sand to 35′; clay and little streak of sand to 28′; sand to 109′; clay to 119′; brown shale, with heavy oil, to 136′; brown shale and gas to 153′; sand to 156′; brown shale to 162′; shale mixed with green rock to 170′; dark sand, with showing of oil, to 190′; hard shale (brown) to 200′. This well is 30′ west of well No. 1. Drilled in 1894.

Well No. 3: Sand and gravel to 30′; green clay and thin stratum of brown shale to 112′; coarse gravel and sand, with gas and heavy oil, to 141′; streaks of clay mixed with sand rock to 180′; shale to 184′; brown sand rock to 200′; brown shale to 228′; marl filled with sea-shells to 336′; brown shale to 345′; mud streak to 406′; soft brown shale to 437′; very dark shell rock and salt water to 478′; gray sand, with strong flow of gas, to 490′ (at this depth the gas raised water over derrick); gray sand and more gas to 505′; dark slate rock filled with sea-shells to 520′; sand rock, with asphaltum, to 525′; hard shale to 557′; mud streak to 565′; brown shale, full of oil, to 570′; brown shale, with more oil and gas, to 574′. Drilling was still in progress, the formation being shale, with oil and gas, when record was obtained. Drilled in 1896–97.

CHAPTER 3.

SAN MATEO COUNTY.

9.3.1. Oil-yielding formations have been traced through many portions of San Mateo County, and there are numerous seepages of petroleum; there are also deposits of asphaltum on the Savage ranch about 2 miles southeast of Spanishtown. The only productive wells yet obtained in San Mateo County are wells less than 500′ deep drilled on the Purissima and Tunitas creeks. Since 1890, several wells have been drilled on land adjacent to Purissima Creek about 4 miles southeast of Spanishtown, the deepest being only 350′. The formation is sandstone and dark-colored shale. It is said that none of these wells yielded more than 2 bbls. of oil a day, and that the specific gravity of the oil was 42° B.

About 10 miles southeast of Spanishtown on Tunitas Creek, two or more wells were drilled several years ago. The formation resembled

that penetrated by the wells on Purissima Creek. The deepest of these wells is 560′. It is said that none of these wells yielded more than 2 bbls. of oil a day, and that the gravity of the oil was 48° B. A few fossils were obtained from one of the wells on Tunitas Creek. They were identified by Dr. J. G. Cooper, and proved to be of Eocene age.

9.3.2. *The Paraffin Oil Company* (of San Mateo; G. D. Roberts of Los Angeles, president). In July, 1900, this company was drilling a well on land adjacent to the Purissima Creek at a point 400′ higher than, and 1100′ east of, an old well drilled several years ago. At the date mentioned, this well was said to be 600′ deep. Oil of 51° B. had been struck at 450′, and it was thought that the well would produce 3 bbls. a day. The oil had been cased off, and the well was being deepened. The formation is sandstone and shale. There was some gas. Oil for fuel was obtained from the oil-well previously referred to.

9.3.3. *Wells near Half Moon Bay.* About three years ago E. J. Bean drilled for oil on land now owned by Joseph Fernandez, situated 1½ miles south of Half Moon Bay, near Clam Rock, about 800′ from the beach. Well No. 1, 700′ deep, caved in, and was abandoned. Well No. 2, 10′ from No. 1, 900′ deep; 700′ of casing; tools lost in the well, and the well abandoned. Well No. 3, 10′ from No. 2, 1300′ deep; abandoned on account of lack of funds.

About 1½ miles south of the Bean wells, a well was drilled many years ago, of which no reliable data can now be obtained. More than twenty years ago, oil was prospected for on the ranch of R. D. Savage, about 1½ miles easterly from Half Moon Bay. About 1896, George Owens drilled a well in the gulch to the east of Savage's house. It is stated that at a depth of 30′, a 20′ stratum of oil-sand was struck which yielded a heavy black oil. The oil has since risen to within 2′ of the surface. This well was drilled to a depth of 1200′, at which depth granite was struck and the well abandoned. It is said that a stratum of dry oil-sand was struck before reaching the granite. About a year ago, Mr. Sidney Smith drilled a well 600′ east of the Owens well. At a depth of 30′ a stratum yielding a heavy black oil similar to that of the Owens well was penetrated to a depth of 60′, but the well was abandoned. In this well, also, the oil has risen to within 2′ of the surface. These wells are less than 3 miles from the ocean, and about 600′ above sea-level.

9.3.4. In May, 1898, Mr. McNee and others drilled three wells about 300′ from Draffin's Beach, about 9 miles from Half Moon Bay. It is said that in one at a depth of 200′, and in each of the others at less than 100′, granite was encountered, and the wells abandoned. The formation is as follows: Well No. 1: Soil to 3′; yellow clay to 21′; blue clay to 40′; water-sand and pebbles to 60′; blue sand to 84′; blue clay to 90′; oil-sand to 114′ (end of casing); granite to 150′; blue quartz to 158′; granite to 178′; quartz to 196′; granite to 200′. Well No. 2: Soil to 15′;

clay to 20′; yellow sand to 45′; gray sand to 50′; coarse pebbles, with water, to 58′; blue sand and coarse gravel, with a little oil, to 62′; gray sand, with oil, to 67′; clay and sand, traces of oil, to 71′; blue clay, with traces of oil, to 75′; green sand to 77′; granite to 80′.

CHAPTER 4.

CONTRA COSTA COUNTY.

9.4.1. The existence of petroleum in Contra Costa County has been known as long ago as 1864. At that date J. W. Cruikshank (now of Paso Robles) drilled several experimental wells about 1½ miles south of the Empire coal mine. One of these wells was drilled to a depth of 300′. Mr. Cruikshank states that in one well he struck a green oil of high specific gravity, and pumped about 15 bbls.

In 1865 the Adams Petroleum Company was organized; several shallow wells were drilled, and some oil was obtained. It is said that the drilling machinery used was inadequate, and the enterprise was abandoned. The Adams Petroleum Company operated on land which is now a part of the Coates estate.

9.4.2. *American Oil and Refinery Company* (of San Francisco; W. E. Holbrook, president) has a well on the Minor ranch, about 1½ miles from Orinda Park postoffice. It is said that this well is 1300′ deep. The formation penetrated is shown by the following record: Alluvium to 15′; gray sandstone to 90′; tough clay to 215′; fine-grained, bluish sandstone to 900′. Salt water flows from this well, and when the water is stirred inflammable gas rises to the surface. Tools were lost in the well and it was abandoned. The company then selected another well-site near the first well, and in October, 1900, a new drilling plant had been set up. In the creek-bed near the new well-site, sandstone and shale are exposed and there are seepages of petroleum.

9.4.3. *Contra Costa Oil and Petroleum Company* (of San Francisco; L. R. Mead, president) has bonded a portion of the Coates estate, and has selected a well-site about 1½ miles south of the Empire coal mine. In October, 1900, this company had erected a derrick and had machinery on the ground ready to drill. The land on which the derrick of this company stands was the scene of one of the earliest attempts at oil-mining in California, and some oil was found, as before recorded.

9.4.4. *Grand Pacific Oil Company* (A. G. Deardorf, president) has bonded the ranch of Josephus Hodges, about a mile east of Lafayette. In October, 1900, this company had selected a well-site and had a drilling plant on the ground.

9.4.5. *McCamley Ranch* (near San Ramon). It is said that shallow ɔrospect wells have been sunk on this ranch, with satisfactory results.

9.4.6. *Mount Diablo Oil Company* (of San Francisco; G. W. Terrill, ɔresident) has secured control of the Old Tar ranch, situated about 2 miles easterly from San Pablo. Oil was found on this ranch many years ago, and several shallow wells have been drilled on it. In 1899, Mr. J. W. Laymance of Oakland drilled a 170′ well. He states that much seepage oil was found. In October, 1900, a drilling plant was on the ground.

9.4.7. *Point Richmond Oil Company* (of San Francisco; H. B. Russ, ɔresident) has two 100′ wells on the Mulford ranch, 3 miles northeast of San Pablo. There is a seepage of heavy oil near these wells.

9.4.8. *San Pablo Oil Company* (E. L. Doheny of Los Angeles, president) has a well about a mile northeast of San Pablo on the ranch of T. W. Mulford. The well is about 500′ above sea-level. It is said that the company has drilled 670′, and that traces of oil have been found. Inflammable gas escapes from the well.

9.4.9. *Sobrante Oil and Investment Company* (C. Harris, president) has secured land upon the Castro tract. The well-site chosen is about 1¼ miles northeasterly from the Mount Diablo Company's wells, and is about 160′ above sea-level. It is said that there are indications of oil in the vicinity.

9.4.10. *Tide Water Oil Development Company* (C. D. Howry, president) has a well about 1 mile south of the well-site of the Contra Costa Oil and Petroleum Company. The well is on the Coates estate. In October, 1900, this well was about 300′ deep. Water was struck at 250′.

PART 10.

MENDOCINO, COLUSA, HUMBOLDT, AND NAPA COUNTIES.

CHAPTER 1.

MENDOCINO COUNTY.

10.1.1. In Mendocino County petroleum-yielding formations have been discovered in several places, the best known being Point Arena, where ledges of oil-sand are exposed.

As described by Mr. Goodyear in the VIIth Report of the California State Mining Bureau, several prospect wells had been drilled at Point Arena prior to 1887, but no valuable quantity of oil was obtained.

During the past two years other prospect wells have been drilled at Point Arena. The following history of these enterprises is contributed by Mr. H. Howe of that place:

10.1.2. The Watson Oil Company of Napa Junction, California, drilled a 700′ well on the Curley ranch, about 1½ miles northwest of Point Arena. The formation is sandstone and soft rock. At 700′ a stratum of asphaltum was struck. This company then drilled a second well on the Porter O'Neill ranch, a short distance west of the first well. This well was between 600′ and 700′ deep; it is abandoned.

10.1.3. The interests of the Watson Oil Company were purchased by the White Lumber Company of San Francisco, and others, who drilled two 400′ wells on the land of the White Lumber Company. These wells are about 100 yards northwest of the chutes where the lumber company load their vessels. The records of these wells are similar to the records of the wells of the Watson Oil Company. Asphaltum was struck; it could not be penetrated, and the wells were abandoned.

CHAPTER 2.

COLUSA COUNTY.

10.2.1. As mentioned in Bulletin No. 3, published by the California State Mining Bureau, the existence of petroleum in Colusa County has been known for many years. At an early day in the history of the county, some prospecting was done on the McMichael and the Stoval ranches, near the Mountain House, on the Lake County road. Formations which yield inflammable gas are exposed at the Peterson ranch, near Sites; and at the Elgin mine, near Sulphur Creek; and at several other places in Colusa County.

10.2.2. In the winter of 1896, the writer made a reconnaissance of a portion of Bear Creek, where some of the springs of petroleum were said to exist. In T. 14 N., R. 5 W., M. D. M., about a mile east of Sulphur Creek P. O., on land owned by T. Sheerer and M. A. Long & Sons, of the village of Williams, Colusa County, petroleum was found oozing from the rocks. The general character of the formation exposed along Bear Creek is shale and sandstone, with thin strata of impure limestone.

10.2.3. A few fossils were obtained, which indicated that these rocks were deposited during the Cretaceous period. In many places, the stratified rocks show metamorphic action.

The summits of the adjacent hills, especially to the west of Bear Creek, consist of serpentine, and on the flanks of the hills the stratified rocks are much obscured by blocks of serpentine and earth. The structure of the stratified rocks is that of compressed anticlinal folds.

The first oil-seepage inspected is near the S.E. corner of Sec. 21, in the bed of a little creek emptying into Bear Creek.

10.2.4. At the point named a small quantity of greenish petroleum and mineral water issues from a deposit of calcareous tufa which covers the stratified rocks.

The dip of the last-mentioned rocks, as observed in the bed of Bear Creek, is N. 50° E., and the angle of inclination is about 70°.

On the hill-side east of Bear Creek, near the mouth of Sulphur Creek, there is a coarse sandstone containing numerous fossils (*Aucella*), but they are much decomposed.

At several places in the bed of Bear Creek, and for a distance of about half a mile below the mouth of Sulphur Creek, strata of shale and sandstone are exposed. They dip N. 50° E. and N. 60° E., at an angle of from 50° to 80°.

10.2.5. A short distance south of the S.E. corner of the S.W. ¼ of the N.W. ¼ of Sec. 27, T. 14 N., R. 5 W., M. D. M., Bear Creek crosses an anticlinal axis. The dip of the formation is S. 25° W. and N. 25° E. at

an angle of about 70°. At and near the axis there is a slight showing of oil in the creek.

Farther down Bear Creek, the formation is shale; it is much crushed, and small quantities of oil are said to exude from it in hot weather. Near the N.E. corner of the S.W. ¼ of Sec. 27, Bear Creek has cut through a thick stratum of sandstone. This stratum is the source of several springs of sulphureted water, on the surface of which a small quantity of oil was floating.

10.2.6. It is said that many years ago a 6″ well was sunk to a depth of 200′ in this sandstone, and that it yielded more than 1 bbl. of oil a day. In December, 1896, this well was full of sulphureted water, on the surface of which there was a slight showing of oil.

The above-mentioned sandstone stratum is much fractured, and, except where it is broken by a fault, the dip is about S. 30° E., at an angle of 75°. Near the well, the sandstone contains numerous specimens of *Aucella*.

Another seepage of oil was observed in the creek-bed, in the N.E. ¼ of Sec. 34. At this point, the formation is sandstone, and the angle of the dip decreases about 35°. It is said that a small amount of coal is found in this sandstone.

A short distance farther southward, the sandstone dips to the northeast, at an angle of about 85°. Farther down Bear Creek, the exposed rocks are for the most part serpentine. As this creek enters Section 35, it has a general course of about S. 80° E., and the rocks are obscured by earth and drift.

10.2.7. Still farther down Bear Creek, near the S.E. corner of Sec. 35, strata of sandstone and impure limestone dip N. 23° E. at an angle of about 70°, and gas bubbles up in the creek at several places. Near the S.E. corner of Sec. 35, there are seepages of petroleum, and some work, consisting of open cuts, pits, and tunnels, has been done by Mr. J. P. Rathburn of the village of Williams. Most of these workings are in the serpentine drift which covers the stratified rocks. From one of these openings a small quantity of petroleum and mineral water was running into a trough. Samples of petroleum were obtained from this trough, and from the surface of the water which had collected in the workings. The petroleum in the trough had been exposed to the weather for a long time, and had thrown down a flocculent precipitate, resembling the sludge, or b. s., found in petroleum from other localities. No signs of asphaltum were seen on Bear Creek.

Samples of this petroleum and precipitate were examined by the writer in the laboratory of the State Mining Bureau. The results of this examination are given in Chapter 5, Part 12, of this Bulletin. When the flocculent precipitate above mentioned was heated, it separated into water, oil, and earthy or organic matter.

In September, 1900, the following companies were drilling in Colusa County:

10.2.8. *Herron Oil Company* (of Los Angeles) has one well in the S.E. ¼ of Sec. 35, T. 14 N., R. 5 W., M. D. M. Formation: Serpentine (loose rocks) to 100′; shale to 800′. Some oil was obtained, apparently seepage, from the serpentine. Drilling.

10.2.9. *Gorrell & Smith Oil Company* has a 543′ well in the S.E. ¼ of Sec. 7, T. 13 N., R. 3 W., M. D. M.

CHAPTER 3.

HUMBOLDT COUNTY.

By F. M. Anderson, C.E.

10.3.1. The existence of oil in Humboldt County has been known from an early date. A full account of the attempts made here in 1865–67 will be found in the VIIth Report of the State Mineralogist, pages 195–202. According to the author, Mr. Adolph H. Weber, no less than twenty-five wells were sunk at that date, but the total amount of oil produced by any of them did not exceed 100 bbls., which was the quantity taken from the Union well on the north fork of the Mattole River. Smaller quantities were taken from other wells, but all of them had to be pumped. The abandonment of these prospects at that date is said to be largely due to the views held at the Land Office regarding location of these lands.

The oil-bearing formation is stated by Mr. Weber to be a close-grained, light-gray sandstone, overlain by bluish clay-shales.

A feebler effort was made in 1892–93, but little or no success was attained, for reasons that will appear later.

A third and more promising effort to obtain oil in paying quantities has been more recently made and is now in active progress. During the spring and summer of 1900 no less than six companies began operations in southwestern Humboldt County in search of oil. At the date of this report (September, 1900) only three companies were actually drilling, and only one had reached any considerable depth.

10.3.2. *The Mackintosh Well*, situated on the Cook ranch (Sec. 29, T. 1 S., R. 2 W.), is being drilled by Mr. A. Mackintosh under a term lease. It is on a low ridge separating the two branches of McNutt Gulch, near the site of the old Muldrow well of 1865. The present well has reached a depth of more than 1200′, passing mainly through blue and yellow clay-shales and sandstone, which are at intervals more or less

bituminous, but not yet sufficiently so to be profitably productive. The present capacity of the well does not probably exceed 2 bbls. per day, but it is expected that with greater depth more productive strata will be reached. Oil was struck at a depth of 300′ and again at 1100′, from which depth the greater portion is believed to come. The oil is of good quality, having a specific gravity of 0.860 and from 33° to 34° B.

10.3.3. *The Craig Well*, situated on the lower north fork of the Mattole River, near the site of the old Union well (Sec. 30, T. 1 S., R. 1. W.), is being drilled under a contract by Mr. Allen Craig, as directed under the management of Major Bulyer and others. The present depth is about 300′. The formation is mainly sandstone.

10.3.4. *The Humboldt Oil Company*, consisting of Dr. E. L. Dow, A. F. Coffin, and others, has drilled to a depth of nearly 200′ on a tributary of the Mattole known as Buckeye Creek (Sec. 6, T. 2 S., R. 1 W.). The formation is mainly sandstone and shale, no bituminous strata having yet been reached.

10.3.5. *Other companies* actually making preparations for drilling are as follows: T. L. Reed & Co. have two derricks in progress of erection, with proper equipments (Secs. 14 and 24, T. 1 S., R. 2 W.); the Wild Goose Company (Kroeger, Coffin, Dow, and others) is erecting a derrick at Joel's Flat, near the site of a former somewhat productive well (Sec. 15, T. 1 S., R. 2 W.); and the Mattole Paraffin Company, including the firm of Baker & Hamilton, is erecting a derrick, with equipments, on the upper north fork of the Mattole (Sec. 2, T. 3 S., R. 1 W.). All of these and still other companies have secured leases or other titles to large and desirable tracts of land in the Mattole Valley for the purpose of thorough prospecting.

10.3.6. *Extent of Oil Lands.*—The true extent of the territory in Humboldt County that might be classed as oil-lands is very vaguely known. At present, the chief district is that of the Mattole Valley. Promising indications have been recognized along the Bear River, at Oil Creek, Ferndale, Scotia, and Eureka. In fact, much of the southwestern portion of the county is known to be underlain by more or less bituminous strata.

This belt extends along the southern coast of the county for a distance of 60 miles or more, and with an average width of 12 or 15 miles. The belt consists chiefly or entirely of Neocene strata, the upper portions of which include the Wild Cat series of Prof. A. C. Lawson, which is usually fossiliferous. The lower portions consist of yellow or blue sandstones and shales, with some interstratified beds of chert and limestone. No recognizable fossils have yet been found by which their age can be certainly determined, but their general aspect, situation, and bituminous character lead to the belief that they are not older than the Miocene. The oil-bearing members of the series are moderately fine-grained sand-

stones, often loose and porous in texture, but also occasionally pretty hard. Where fresh and bituminous samples of the rock are to be seen it is dark in color, but bleaches in the weather to a light-gray or yellowish sandstone. It often contains lenses or strata of pebbly sandstone or conglomerate. No satisfactory section of the series has yet been made.

10 3.7. *Structural Features of the District.*—The geological structure of this belt is not very simple. A great deal of faulting has broken the country into numerous blocks that have on the whole something of a systematic arrangement. Most of the topographical features of the country trend northwesterly. The more conspicuous fault-lines have a similar course, though they are often sinuous and not easily followed for a great distance. Transverse faulting is common, though less pronounced. Most of the faulting appears to be normal. The inclination of these fault-blocks is not regular; in many of them the strata dip toward the southwest, or westerly, and in some cases they dip in other directions. It is stated by local observers that everything dips southwesterly or in the opposite direction. There are several prominent lines or zones of faulting, some of which deserve to be mentioned.

10.3.8. The Mattole Valley, which contains the field most prospected for oil at the present, is evidently a structural valley, developed by normal faulting. To one unfamiliar with the structural features of the county its existence is a surprise. It is surrounded on all sides by hills that attain a general elevation of nearly 2500′, among which it has been sunk to a general level of 200′ to 800′. Even along the coast it is shut off from the sea by a comparatively high and narrow line of hills. The river passes from the valley to the ocean through a narrow gorge in this breastwork of ridges. Two chief lines of faulting run somewhat parallel in a southeasterly direction from the coast and determine the trend and, in part, the borders of the valley. One of these lines follows the northern border, and is in evidence along the southern face of the hills 3 miles north of Petrolia. The other line lies nearly as far south of the town and is perhaps followed by the upper portion of Squaw Creek Valley. Fault-lines intermediate between these two are easily found. In some places sharp folds in the strata are to be seen which have left the beds in a steeply inclined position. The structural conditions of the country, which are always important in an oil-district, ought especially to be studied here, and it is to the interest of the county as well as to prospecting companies to secure a clear statement of these facts by a competent expert early in the history of prospecting for oil.

10.3.9. *Evidences of Petroleum.*—There are many proofs of the presence of oil in this district, chief among which are the oil-springs and seepages and vents of the hydrocarbon gases everywhere known. These "indications" fall into line in their distribution, forming two or three well-marked zones traversing the country in a southwesterly direction.

This fact has led to the general recognition of as many distinct "oil-belts" in the vicinity of the Mattole and Bear rivers. A cursory examination of the country makes it apparent that these lines agree with the principal fault-lines already described. Connected with nearly all the springs of oil or gas there are more or less clearly recognizable evidences of faulting. This is expressed either in the presence of escarpments, often somewhat reduced by erosion, or in the highly tilted and broken strata which in some cases are even brecciated. This is true at the "Osborne Spring," where brecciated sandstone forms a portion of the very steep slope of the hill that marks the position of a transverse fault. The brecciated appearance of the rock here has led some to suppose that the oil-bearing strata were pebbly sandstone. Similar facts are observed along Bear River, at the Morrison ranch, and elsewhere, the "Guptell Spring" being apparently situated on a line of faulting. Some of these springs afford a few gallons of oil per week for a portion of the year, but most of them are small seepages. Gas springs are fairly common, particularly along Bear River, and at other points farther north. At Briceland, near the head of Mattole Valley, some 25 miles southeast of Petrolia, natural gas from a well drilled for oil is used for light and fuel. Gas, and petroleum, too, have been struck in the deep borings for water in the town of Eureka. Other places still farther north are reported to afford indications, but they are not well known. It is stated that at the present time over 12,000 acres of land in southern Humboldt County are filed on as "mineral locations."

10.3.10. *Character of the Oil.*—As to the character of the oil found in the seepages and in the wells, it may be said that it has generally been pronounced to be of superior quality. It is claimed that the oil from the "Osborne Spring," which is of unusual quality, has often been used for lighting in ordinary lamps. It is a dichroic oil, showing considerable fluorescence, appearing of a reddish amber color in transmitted light, while in reflected light it is a dark olive-green. It has a density of 30° B. and a specific gravity of 0.875.

Most of the seepage oils are similar, but are usually darker and thicker, with a greater specific gravity. Oil from the Mackintosh well is considerably darker in color, being translucent only in thin films, with a density of 33° to 34° B., and with a gravity of 0.860. Upon exposure to air it becomes still darker in color and loses much of its fluidity by the volatilization of some of its lighter ingredients. The oils of this district differ from those of other sections of California in the fact that they contain a smaller percentage of asphalt bases and a relatively larger percentage of paraffin.

10.3.11. *Promise of the District.*—From what has already been said, the apparent promise of this district may be inferred. The presence of oil cannot of course be doubted, but it yet remains to be demonstrated

whether it can be found in paying quantities. No attempt has yet been made to ascertain the facts available to scientific search in answer to this question. As usual, prospecting has been carried on without any study of the field by a geologist competent to give it direction. Among the things which such an investigator would deem desirable to know and which his science would enable him to discover are two of paramount importance: (1) What is the character, richness, and extent of the oil-bearing strata? (2) What are the structural peculiarities of the country? And considering the present stage of development of this district, the question might be subjoined: If oil exists in paying quantities, why has it not been reached by the drill?

No satisfactory answer to these questions can be made in this report, but a few impressions may be worth recording. Concerning the first question, it is commonly believed that the oil-bearing strata are mainly of close-grained sandstone, often quite hard, and existing in comparatively thin beds. No attempt has been made to determine their real extent or to learn their aggregate thickness. Alternating beds of sandstone and shale is the rule in parts of the series. The whole series of strata ought to be better known. Close-grained rock is not the most favorable for containing oil.

One often hears in this district the fear expressed that the country is "too much broken." Faulting is indeed common, but it is less frequent than is generally believed. It follows chiefly a few prominent zones trending southeasterly through the country. Most of the seepages of oil and gaseous emissions are along these lines of faulting. Most, if not all, of the wells thus far sunk are comparatively near the seepages, and consequently along the lines of faulting. For several reasons such a location for a well is not the most favorable, although the seepages seem to indicate the presence of oil at such points. It ought to be remembered, however, that if the vents opened by faulting or otherwise are of long duration the oils from their vicinity may have been largely drained off, and are therefore no longer available. A better location would be at a point somewhat removed from such faulting, other things being equal. It is possible, if not probable, that paying quantities of oil have not yet been reached only because wells have so far been sunk in exhausted portions of the field. Similar observations have been recorded for other districts of California in former years. In the VIIth Report of the State Mineralogist, page 41, Mr. W. A. Goodyear remarks: "It was believed in the early days of our petroleum excitement that where oil was found upon the surface, or seen issuing from the ground, such points were the proper places to sink for the reservoirs; but experience has taught us the fallacy of early convictions, as the present producing wells have demonstrated. In passing over our oil-belt it is noticeable that nearly all the earlier workings, afterward abandoned, were in close proximity

to the exudations, or in ravines." Such statements, if true, ought not to be ignored in any district. Something like a recognition of such principles is contained in the common belief that a "much-broken" country is not favorable for oil in large quantities. On the whole, it may be truthfully said that the best success in reaching oil in this district in commercial quantities will be attained by the employment of some one able to interpret the indications and the structure of the country correctly, for the purpose of making a detailed report upon it.

CHAPTER 4.

NAPA COUNTY.

PETROLEUM.

10.4.1. *Mount Shasta Oil and Development Company* (J. E. Finnell, president) has an oil-spring in the N.E. ¼ of Sec. 32, T. 10 N., R. 3 W., M. D. M., on the western slope of the Blue Mountain range, about 6 miles northeast of Monticello, on property owned by Mrs. Harris. Elevation, about 1000′. The spring occurs in a fissure in blue sandstone resting on dark-colored shale. Gas issues from an orifice in the sandstone about 2′ from the mouth of the oil-spring. The flow of oil is intermittent, and is accompanied with water. The spring produces about 4 gals. of oil in twenty-four hours. The oil is said to be an excellent lubricant. An analysis by Mr. Krutzman, chemist to the Pacific Refining and Roofing Company, gives the following:

Analysis of Oil from Berryessa Valley, Napa County.

Specific gravity of crude oil	0.9642.	Viscosity,	4.87
Light lubricating oil	24%	"	2.91
Heavy lubricating oil	22%	"	28.80
Gas oil	32%		
Residue	18%		
	96%		

Asphalt in residue, 3.66%; sulphur, no trace.

The Harris Cañon, in which the oil-spring is located, runs nearly east and west from its mouth to the site of the spring. The formation consists of alternate strata of shale and grayish sandstone. The strike is northwest and southeast, and the angle of the dip varies from 55° to 80°.

It is said that at the quicksilver mine at Knoxville, 22 miles north, a seepage of similar oil occurred between the 300′ and 400′ levels, and that the oil was used for lubricating the machinery at the mine.

PART 11.

PIPE-LINES AND REFINERIES.

CHAPTER 1.

PIPE-LINES.

11.1.1. It has long been known that tables which supply information concerning the transmission of water through pipe-lines are not applicable to the conveyance of oil by pipe-lines. Since the publication of Bulletin No. 11 the writer has received numerous inquiries concerning this subject. The data he has obtained on this important question are therefore placed in one chapter, in the hope that some idea as to the conveyance of California oil by pipe-line may be gathered therefrom.

11.1.2. *Central Oil Company.*—The oil from the wells of this company is conveyed by pipe-line to Los Nietos, on the Santa Fé Railroad, a distance of about 4¾ miles. It is a 4″ pipe-line, and has a head of 700′. Along its course there are no undulations which exceed 25′ in variation of altitude. At a temperature of about 65° F. this pipe-line discharges at the rate of about 60 bbls. an hour. The gravity of the oil is about 21° B.

11.1.3. *Oil City* (*Fresno County*) *Pipe-Line.*—This line conveys the oil from the Oil City wells to Ora Station on the S. P. R. R. This is a 3″ line. It is 8½ miles in length; the difference in elevation between the head and point of discharge is 600′. The gravity of the oil is 33° B. An experiment of ten hours' duration showed that the oil could be discharged at the rate of 125 bbls. an hour, the temperature of the oil being about 60° F. In hot weather the discharge is less and irregular, owing to the gas generating in the pipe-line, which collects at the high points and retards the flow. When the pipe-line was first laid it was above ground, and the retardation of the flow in the summer time amounted to 25 bbls. an hour. Subsequently the pipe-line was covered with earth, and the retardation of the flow was made less.

11.1.4. *Puente Oil Company.*—The pipe-line of this company extends from their wells in the Puente Hills to their refinery at Chino, a distance of 15 miles. It is a 5″ pipe-line, and the head is about 700′.

The gravity of the oil averages 33° B. The discharge is about 1 bbl. a minute at a temperature of 60° F. Along this line there are several undulations, some of which show a variation in altitude of more than 100′.

11.1.5. *Pacific Coast Oil Company.*—The pipe-line of this company conveys the oil from their wells in Pico Cañon, Los Angeles County, to the seashore at Ventura, in Ventura County, a distance of 44 miles. For 20 miles from the wells, the line is 2″ pipe, and from that point to Ventura, a distance of 24 miles, it is 3″ pipe. The head is about 1900′. The greatest undulation is about 200′, and for nearly the entire distance the grade is uniform and nearly level. This pipe discharges by gravity at the rate of 25 bbls. an hour at a temperature of 65° F. The gravity of the oil is about 41.5° B. The Pacific Coast Oil Company has also a pipe-line extending from their wells in Pico Cañon to the railroad at Newhall. This line is about 7 miles long, and is of 2″ pipe. It has a head of about 600′, and at a temperature of about 65° F. it will discharge by gravity at the rate of about 30 bbls. an hour.

11.1.6. *Sunset Oil Company* (of Ventura County).—The pipe-line of this company conveys the oil from their wells in Hopper Cañon to Buckhorn Station on the Santa Barbara branch of the S. P. R. R., Ventura County. This is a 2″ pipe-line, and about 5 miles long. It has been laid with no regard to hydraulic grade. It has a head of about 500′, and along its course there are no undulations in which the difference of altitude is more than 50′. The oil is about 12° B., and is mixed with about equal volumes of water. The water and oil pass through the pipe-line in a rotating column, the oil forming a core in the center of the column. In summer time the discharge from the end of this pipe at Buckhorn is about 250 bbls. in twelve hours; in winter time, 250 bbls. in eighteen hours.

11.1.7. *Union Oil Company* (of Santa Paula).—The oil from the various oil-fields owned and controlled by this company is conducted by pipe-lines to a trunk line in the Santa Clara Valley by which the oil is conveyed to the seashore at the mouth of the Sespe River. It is a 4″ line, and is about 25 miles in length, although the distance between Santa Paula and Ventura is less than 20 miles in an air line. The feeders are usually 2″ and 3″ pipe. The total length of pipe-line belonging to the Union Oil Company's pipe-line system in Ventura County is said to be 100 miles. No particulars could be obtained about the rate of discharge. The facts relating to the following interesting experiment were kindly furnished by Mr. Lyman Stewart, president of the Union Oil Company: Several years ago, oil from the Astarte wells in the Sisar Cañon, Ventura County, was conveyed by a 2″ pipe-line to a tank in the Santa Paula Cañon, a distance of 3 miles, with a fall of 300′. The oil had a gravity of about 13° B., and at a temperature of 60° F. the dis-

charge by gravity was at the rate of 20 bbls. in twenty-four hours. As an experiment the oil in the pipe-line was placed under a pressure of 800 lbs. to the square inch, but the discharge was only increased to 24 bbls. in twenty-four hours. When the pressure was increased it burst the pipe-line.

11.1.8. *Union Oil Company's Pipe-Line at Los Angeles.*—The pipe-line of the Union Oil Company extends from First and Lake Shore streets, in the Los Angeles oil-field, to Palmetto and San Mateo streets, on the S. P. R. R., a distance of about 4 miles. It is a 4″ line, and the course followed is undulating. The gravity of the oil is 14° B. It is forced through the pipe-line under a pressure of 600 lbs. Some trouble is experienced from the sand which the oil contains accumulating in low places in the pipe-line. In summer the discharge from this line is about 800 bbls. in twenty-four hours; in winter, about one third less.

The pipe-line of the Union Oil Company in Orange County extends from the Fullerton oil-field to Bixby, a distance of 26 miles. This is a 4″ line and has a head of 450′. The gravity of the oil which runs through this line averages 21° B., and at a temperature of about 65° F. the rate of discharge is about 2000 bbls. in twenty-four hours.

11.1.9. *Alcatraz Refinery Pipe-Line.*—This line conveys a solution of asphaltum dissolved in distillate from the mines of bituminous sandstone at Sisquoc to the company's refinery at Alcatraz Landing, Santa Barbara County. The length of the pipe-line is about 37 miles; diameter of the pipe, 3″. The difference in elevation between Sisquoc and Alcatraz Landing is 1900′. Along the pipe-line there are several undulations, one of which shows a difference in elevation of about 1000′. The gravity of the solution is about 25° B.

The following interesting data concerning the rate of discharge from a pipe-line in the Eastern States were furnished the writer by Mr. Lyman Stewart of the Union Oil Company: There was a 4″ pipe-line running from Duke Center, Pennsylvania, to Olean, in New York, a distance of about 13 miles. The course is undulating, and the line ran over hills about 900′ higher than the pumping station. Oil having a gravity of 47° B. was transmitted through this pipe-line under a pressure of about 1150 lbs., the discharge being at the rate of 15,000 bbls. of oil in twenty-four hours.

11.1.10. *The Modelo Oil Company's Pipe-Line.*—It extends between the Modelo oil-wells and the railroad at Piru, Ventura County. This is a 2″ pipe-line and is about 3 miles in length; the difference in elevation between the head and the point of discharge is about 800′. The gravity of the oil is 28° B.

11.1.11. Some information concerning the discharge of oil through pipe-lines can be gathered from the following tables:

DISCHARGE OF OIL BY GRAVITY.

Pipe-Lines.	Length of Pipe-Line	Diameter of Pipe	Spec. Gravity of Oil.	Head.	Temperature	Rate of Discharge in 24 Hours	Remarks.
	Miles.	*Inches.*		*Feet.*		*Bbls.*	
Central Oil Co.'s pipe-line Between Central Oil Wells and Los Nietos, Los Angeles County.	4.65	4	21° B.	700	65° F.	1440	No great undulations.
Union Oil Co.'s pipe-line Between Astarte Wells and Santa Paula, Ventura Co.	3.00	2	13° B.	300	60° F.	20	No great undulations.
Union Oil Co.'s pipe-line In Orange County, between Fullerton oil-field and Bixby.	26.00	4	21° B.	450	65° F.	2000	No great undulations.
Sunset Oil Co.'s pipe-line Bet. Sunset Wells and Buckhorn R. R. Station, Ventura Co.	5.00	2	12° B.	500	75° F. in summer, 60° F. in winter.	500 350	No great undulations. Oil mixed with about equal volume of water.
Pipe-line between Oil City and Ora Siding on the S. P. R. R., Fresno County	8.50	3	33° B.	600	60° F.	3000	No great undulations.
Puente Oil Co.'s pipe-line Bet. Puente Wells, Los Angeles County, and Chino, San Bernardino County.	15.00	5	33° B.	700	60° F.	1440	Several undulations, some of which differ in elevation more than 100′.
Pacific Coast Oil Co.'s pipe-line Between Pico Cañon and Ventura, Ventura County.	44.00	(*a*)	41.5° B.	1900	65° F.	700	Grade fairly uniform. Undulations differ 200′.
Pacific Coast Oil Co.'s pipe-line Between Pico Cañon and Newhall, Los Angeles County.	7.00	2	41.5° B.	600	65° F.	600	
Alcatraz Refining Co.'s pipe-line Conveying asphaltum solution between Sisquoc mines and Alcatraz Landing, Santa Barbara County.	37.00	3	25° B.	1900	65° F.		Along pipe-line several undulations show variation in elevation of 1000′.

(*a*) For 1 to 20 miles the diameter of pipe-line is 2″; for remaining distance it is 3″.

DISCHARGE OF OIL UNDER PRESSURE.

Name of Company.	Length of Pipe-Line.	Diameter of Pipe.	Spec. Grav. of Oil.	Head.	Approximate Temperature.	Pressure.	Rate of Discharge in 24 Hours.	Remarks.
	Miles.	In.		Feet.		Lbs.	Bbls.	
Union Oil Co., pipe-line at Los Angeles	4.00	4	14° B	200	70° F.	600	800	Course undulating.
Union Oil Co., Astarte wells, Ventura County	3.00	2	13° B	300	60° F.	800	27	No great undulation.
Discharge of Eastern Oil Under Pressure.								
Pipe-line running from Duke Center, Pa., to Olean, N. Y.	13.00	4	47° B	900	60° F.	1150	1500	

CHAPTER 2.

PETROLEUM REFINERIES.*

11.2.1. *American Oil and Asphalt Company* (of Los Angeles) has a refinery at Date and Alhambra streets. Plant consists of two 300-bbl. and three 125-bbl. stills; tankage for crude oil, 2300 bbls. Product: stove distillate, 32° B.; distillate for spraying trees, 28° B.; fuel distillate, 22° B.; asphaltum. Fifteen men are employed.

11.2.2. *Asphaltum and Oil Refinery Company* (of Los Angeles; E. D. Roberts, president) has a refinery at Ninth Street and Santa Fé Railroad track. Plant consists of two 150-bbl. stills, one 55-bbl. still, and one 25-bbl. still. Product: gasoline, gasoline-engine distillate, illuminating, neutral, and fuel oils.

11.2.3. *The Franklin Refining Company* (of Los Angeles; E. H. Dunham, president) has a refinery at 1504 Newton Street. Plant: one 300-bbl. still, four 100-bbl. stills, and three 50-bbl. stills. Product: gasoline, 60° to 64° B.; gas-engine distillate, 43° to 52° B.; gas distillate, 32° to 34° B.; neutral oils, 26° to 28° B.; lubricating oil, 18° to 22° B.; green oil, 15.5° to 16.5° B.; asphaltum. Amount of crude oil handled in 1899 was 20,000 bbls.

11.2.4. *Jewett & Blodget Refinery* is situated at Hazelton, Sunset oil-district, about 40 miles west of Bakersfield. Plant consists of one still, capacity 100 bbls. in twenty-four hours. The Baku process is used. Product: distillate, lubricating oil, and asphaltum. The crude oil yields gas distillate, 20%; lubricating oil, 12%; heavy distillate, 13%;

* For asphaltum refineries, see general report of California State Mining Bureau.

asphaltum, 55%. The product is shipped to Gosford on the McKittrick branch of the S. P. R. R. Gosford is about 8 miles from Bakersfield.

11.2.5. *Paraffin Paint Company* (of San Francisco) has a refinery at Emeryville, Alameda County. Plant consists of three 60-bbl. stills and a tankage of about 360 bbls. Six men are employed. The oils refined by this company are all of high specific gravity, none of them being above 19° B. The product is distillates ranging from 15° B. to 16° B., and asphaltum. The asphaltum constitutes about 22%, by volume, of the crude oil.

11.2.6. *Pacific Coast Oil Company* (of San Francisco) has a refinery at Alameda Point, Alameda County. Plant consists of 13 stills which have a total capacity of 2215 bbls., and the following tankage: For crude oil, 54,000 bbls.; for refined products, 12,000 bbls.; bleachers and agitators, 4000 bbls. Thirty-two men are employed. The petroleum refined by this company is obtained principally from the wells of the Pacific Coast Oil Company near Newhall. The product is gasoline, illuminating and lubricating oils, and other distillates and asphaltum.

11.2.7. *Puente Oil Company's Refinery* is connected by pipe-line with the Puente oil-wells, distance about 15 miles. Plant consists of three 400-bbl. stills, and 95,000 bbls. crude-oil tankage. Manufactured product consists of gasoline, 67° B.; water-white illuminating oil, 45° B.; residuum fuel oil, 18° B. The residuum is about 60% of the crude oil. Output of Puente refinery for 1899: gasoline, 105,000 gals.; painters' benzine, 50,000 gals.; water-white oil, 450,000 gals.; gas-engine distillate, 900,000 gals.; total, 1,505,000 gals., or about 35,833 bbls. The amount of crude oil was 120,000 bbls.

11.2.8. *Southern Refining Company.*—Refinery at First Street and Alhambra Avenue, Los Angeles. Plant, two 25-bbl. stills. Product: gas-engine distillate, 49° B.; stove distillate, 35° B.; gas distillate, 22° B.; neutral oils, 22° B.; lubricating stock, 16° B.; asphaltum.

11.2.9. *Sunset Oil Refining Company* (J. A. Tubbs, Pittsburg, Pa., president).—Works situated at Obispo, Terminal Island, Los Angeles County. Plant consists of eight stills; total capacity, 1200 bbls. a day. Tankage for crude oil, 25,000 bbls. Product: gasoline, illuminating oil, lubricating oil, and intermediate products. The president of this company informed the writer that a special process was employed at his works which had not previously been used in California. Work was commenced at this refinery in May, 1900, when two stills were in operation, thirty-five men being employed.

11.2.10. *Union Oil Company's Refinery* is at Oleum, Contra Costa County. The stills at these works have a total capacity of 900 bbls. of crude oil. Tankage for refined product, 20,000 bbls.; tankage for crude oil, 70,000 bbls. Product: benzine, 52° to 63° B.; illuminating oil, 43° B.; gas-engine distillate, 39° B.; gas distillate, 28° B.; lubricating oil, 15° to 28° B.; asphaltum.

PART 12.

SUMMARY OF OIL-YIELDING FORMATIONS, CHARACTER OF CALIFORNIA PETROLEUM, AND HISTORICAL SKETCH OF OIL-MINING IN CALIFORNIA.

CHAPTER 1.

GEOGRAPHICAL AND GEOLOGICAL RANGE OF OIL-YIELDING FORMATIONS IN CALIFORNIA.

12.1.1. It is now in order to summarize and compare the leading geographical and geological facts thus far ascertained concerning the occurrence of petroleum in California, and to review the character of the oil-yielding formations and their relation one to another.

Nearly all the oil-fields which at this writing contribute to the petroleum product of California are situated below the 17th township line south of Mount Diablo. (See Fig. M.) The productive oil-fields in the portion of the State referred to are distributed as follows: In the foothills of the Sierras near the eastern extremity of the San Joaquin Valley; on the eastern slope of one of the Coast Ranges which form the western boundary of the San Joaquin Valley; and in other localities of the Coast Ranges which traverse Santa Barbara, Ventura, Los Angeles, and Orange counties.

12.1.2. It must not be supposed that the oil-yielding formations are confined to the localities enumerated, for they constitute a large portion of the mountains composing the Coast Range system. Moreover, in many places they form the bedrock beneath the alluvium of the valley land. It does not necessarily follow that wherever these oil-yielding formations are found they contain oil in valuable quantities, any more than the coal-measures always contain valuable beds of coal; but it is a reasonable conclusion that there are in California numerous areas through which these formations extend wherein new oil-fields will be discovered. This conclusion applies not only to the portions of California described in this Bulletin, but also to a large portion of the State which lies between the foothills of the Sierras and the Pacific Ocean.

THE OIL-YIELDING FORMATIONS OBSERVED BETWEEN THE SESPE AND PIRU CREEKS, VENTURA COUNTY, COMPARED WITH THE OIL-YIELDING FORMATIONS OF OTHER DISTRICTS.

12.1.3. The relative position in point of vertical geologic range of the formations wherein remunerative oil-wells have been obtained in Ventura and Los Angeles counties, is demonstrated by an investigation of the country between Piru and Sespe creeks in Ventura County, where a sequence of formations ranging from the uppermost beds of the Middle Neocene to the lowermost beds of the Eocene are exposed. At Piru Creek, beds of conglomerate occur which contain Neocene fossils, Pliocene forms being the more numerous. (See Table III.) This formation is more than a thousand feet thick, and in one place it was found to be impregnated with petroleum. The conglomerate rests on a clay-shale, likewise containing Neocene fossils. (See Table III.) The lower portion of the shale is interbedded with sandstone strata, and passes into a mass of sandstone, which, in Hopper Cañon (see Fig. 10), shows a thickness of 1100′. In most instances when the lower portion of the Middle Neocene is exposed, strata of sandstone are found more or less impregnated with petroleum. At the mouth of Hopper Cañon, the Middle Neocene shale and sandstone show an aggregate thickness of about 3000′. (See Fig. 9.) The Middle Neocene rocks form a very important series, for, as described in the foregoing pages, by far the greater portion of the oil mined in California is obtained from sandy strata in the lower portion of this group.

12.1.4. Thus, the old-yielding rocks at Elsmere Cañon near Newhall are evidently of Middle Neocene age (see Table III); and, as before described, the outcropping rocks on the south side of the valley of the Santa Clara River indicate that the oil-yielding formations which extend from Newhall to Bardsdale belong to the Middle Neocene series, although the gravity of the oil is less than that of the oil usually obtained from Middle Neocene beds.

12.1.5. In the Puente Hills the Middle Neocene rocks are well represented, and the principal oil-yielding formations are sandstone strata interbedding the lower portion of the Neocene shales. At Summerland, in Santa Barbara County, the character of the oil-yielding formations and their relation to the whitish shales of Lower Neocene age, which are exposed near Carpinteria and in the low ridge of hills immediately east of Summerland, warrant the conclusion that the oil-measures in Summerland are of Middle Neocene age.

12.1.6. On the eastern side of the San Joaquin Valley, we find the oil-field of the Kern River district wherein the oil-measures must be referred to the Middle Neocene series.* On the western side of the San Joaquin Valley, the most productive oil-measures in the Sunset district, the oil-measures of the McKittrick district, and those in the

*See fossils collected in this district, as described in Bulletin No. 3, pp. 39 and 40.

southern portion of the Oil City field in Fresno County, are of Middle Neocene age.* In the San Joaquin Valley, the Middle Neocene formation consists of sandstones and shales, the sandstones predominating, while in Ventura, Los Angeles, and Orange counties, the formations of corresponding age consist of conglomerate and a thick body of shale, the lower portion of which is interstratified with sandstone, passing into a massive body of sandstone at the bottom of the Middle Neocene series.

12.1.7. The oil obtained in the Middle Neocene formation varies greatly in quality, the specific gravity ranging from 12° B. to 30° B. In most districts, however, in which the oil-yielding formations have been identified as of Middle Neocene age, the gravity of the oil ranges between 14° B. and 22° B.

12.1.8. In the territory between Sespe and Piru creeks, the formation immediately underlying the Middle Neocene series is a very characteristic one. It consists of silicious shale. This shale is well exposed in Hopper Cañon and at the Modelo oil-wells, and shows a thickness of about 1500′. When freshly broken, this shale usually smells of petroleum, and in most instances it gives a calcareous reaction with acid. The upper portion of this mass of shale is interbedded with sandstone. There is no marked stratigraphical division between these shales, which rest conformably on a whitish sandstone, and the overlying rocks. Nevertheless, since silicious shale is so characteristic of the Lower Neocene in other portions of California, the writer has tentatively referred the silicious shale of the territory under discussion to that horizon. In Los Angeles County a similar shale is exposed at a few points in the central portion of the Puente Hills, and it is not improbable that the whitish silicious shale seen in the Santiago Cañon in Orange County belongs to this horizon. As previously mentioned, the silicious shale rests on a whitish sandstone formation, which, as is shown in Fig. G, constitutes a large portion of the higher mountains between the Piru and Sespe creeks. This sandstone is evidently several thousand feet in thickness, and contains some fossils which are referred by Dr. J. C. Merriam to the Lower Neocene epoch. (See Table II.)

12.1.9. The silicious shale previously referred to as being in the Puente Hills and in the Santiago Cañon, rests on a thick-bedded sandstone. In the Santiago Cañon this sandstone contains fossils representing the Lower Neocene epoch. On the western side of the San Joaquin Valley the Middle Neocene beds rest non-conformably on a whitish silicious shale, and this rests either on Eocene strata, as at Oil City, or on sandstone or shale of Lower Neocene age, as is the case at the Avenal field in the Kreyenhagen district.† In most instances the oil from these

*See fossils collected in this district, as described in Bulletin No. 3, pp. 38, 43, 49, 54, 55, 56, 58, 59, 63, 64, 65.

†See Bulletin No. 3, p. 53: Fossils collected in Tar Cañon, now called the Avenal field. Recently the writer obtained specimens of *Turritella ocoyana* from this locality. See also same Bulletin, p. 55: Specimens collected in Zapato Chino Creek, Kreyenhagen.

formations has a gravity of more than 25° B. As before stated, the whitish sandstone extends westward from Piru Creek, in Ventura County, to the Sespe oil-district, the distance between the two places being about 8 miles.

12.1.10. At the Sespe oil-district, the whitish sandstone rests probably non-conformably on a shale formation, although the non-conformability is not very apparent. The shale formation is whitish and grayish at the top, passing into a dark-colored shale, which is interbedded with numerous thin strata, or nodular masses, of hard bituminous limestone. These shales rest on a drab-colored sandstone of no great thickness and contain Eocene fossils.* The drab-colored sandstone rests on a brown sandstone, locally known as the Sespe brownstone.

12.1.11. In the Devil's Gate mining district the brownstone rests on whitish sandstone, and the latter on a buff-colored sandstone. The Sespe brownstone, the white sandstone, and the buff-colored sandstone all contain typical Eocene fossils.† All these sandstones are more or less interbedded with shale. The principal oil-yielding formations in the Sespe district are the lowermost portions of the drab-colored shales, the drab sandstone, and the uppermost portion of the Sespe brownstone. These formations have been extensively exploited by the Union Oil Company.

12.1.12. It is probable that the oil-yielding formations in the northern portion of the Oil City field in Fresno County,‡ and those on the Tunitas and Purissima§ creeks in San Mateo County, belong to the same geological horizon as do the oil-yielding rocks of the Sespe district. In the Devil's Gate district there are numerous seepages of petroleum in the hard, buff-colored Eocene sandstones, and productive oil-wells have been obtained. Between the Piru and Sespe districts no marked non-conformability was observed by the writer, the variations of dip being referable rather to local geological disturbance than to non-conformability. Still, it by no means follows that the formations actually rest conformably one on another.

12.1.13. It is conceded that in California the Lower Neocene formations rest non-conformably on the Eocene, and observations in Orange and Los Angeles counties lead to the conclusion that the Middle Neocene shales overlap the underlying formations. There are also some reasons for believing that in Los Angeles County the conglomerate rests non-conformably on the Middle Neocene shales. Since the Eocene period,

*See Bulletin No. 11, pp. 82, 83, 84, 85: Fossils collected at Tar Creek ranch and on a divide between Tar and Maple creeks.

†See Bulletin No. 11, p. 84: Fossils collected at mouth of Stony Corral Creek and Redstone Peak.

‡See Bulletin No. 3, p. 62: Fossils collected at oil-claims 9 miles north of Coalinga, Fresno County.

§Two shells were brought up by the sand pump from a well on Purissima Creek and they were identified by Dr. J. G. Cooper as being of Eocene age.

there have been not only epochs of unusual geologic disturbance, but also disturbances of a secular nature which have produced oscillations of the land surface during the deposition of the Tertiary and Quaternary formations. Similar disturbances continue to this day. It appears that in many instances these disturbances were of local character.

CHAPTER 2.

NEOCENE AND MORE RECENT FORMATIONS IN PORTIONS OF ORANGE AND LOS ANGELES COUNTIES.

12.2.1. As mentioned in a previous chapter, the rocks containing petroleum deposits in Los Angeles and Orange counties are members of a geological series represented by formations which may be studied to advantage in the foothills of the Santa Ana Mountains, between the Santiago Cañon and the cañon of the Santa Ana River. (See Figs. 1, B, and 7.) This series may be correlated with the Lower and Middle Neocene formations observed between the Piru and Sespe creeks in Ventura County, and previously described. In the order of its downward vertical range it consists of conglomerate, shales, and sandstones, the sandstones being for the most part of a whitish color. The whitish sandstones rest on Eocene and Cretaceous formations, and in the portion of the Santa Ana Mountains herein referred to, the Cretaceous formations rest on crystalline rocks. The areas over which these Neocene formations extend are shown in Figs. A, B, and G. The writer made a brief reconnaissance of the portion of the Santa Ana Mountains consisting of eruptive crystalline rocks and the Cretaceous and Eocene formations.

12.2.2. The area occupied by these rocks is marked "Unexplored" in Fig. 1. The fossils obtained from the Cretaceous and Eocene rocks are classified in Table I. They are from localities adjacent to those shown in Figs. 1 and B. It is probable that in the extremity of the Santa Ana Mountains, the formations immediately overlying the crystalline rocks are Cretaceous, and there is reason to believe that there are Eocene formations between the Cretaceous rocks and the whitish sandstone.

12.2.3. Some Lower Neocene (Miocene) fossils were obtained in sandstone in the higher portions of the Santa Ana Mountains, in the S.E. cor. of Sec. 12, T. 4 S., R. 6 W., S. B. M., but the greatest body of this sandstone is found in the foothills. A cross-section of this sandstone is shown in Fig. 7, where it is about 7000′ in thickness.

12.2.4. At the bottom of the whitish sandstone formation there are a few strata of conglomerate, and the pebbles forming this conglomerate are principally quartzose. Whitish sandstone similar to that seen between the Santiago Cañon and the Santa Ana River, forms a large portion of the Puente Hills, and also a large portion of the ridge which traverses Elysian Park at Los Angeles. A similar sandstone forms the central mass on the San Joaquin Hills, and crops out on the shore-line near the southeast corner of Orange County. On the north side of the valley of the Santa Clara River, in Ventura County, a similar whitish sandstone, as previously described, is found resting on Eocene formations. At the Santiago Cañon and in the San Joaquin Hills in Orange County, and at Piru Creek in Ventura County, these sandstones were found to contain Lower Neocene (Miocene) fossils. Near Piru Creek, they yield petroleum in valuable quantities. (See Table II, at end of this Bulletin.)

12.2.5. Resting on this whitish sandstone, near the mouth of the Santiago Cañon, is a very interesting series of shales, the lower portion of which is white or whitish, and the upper portion gray or brown. The whitest of the shales resembles infusorial earth. The upper portion is brown clay-shale, and is, for the most part, thin-bedded. It is interbedded with thin strata of sandstone. At the first glance, it appears improbable that the white shale belongs to the same formation as the overlying brown clay-shale; yet the writer could discover no non-conformability between the white shale and the dark-colored shale overlying it. An inspection of this shale formation in the eastern portion of Orange County showed a gradual transition from the white shale into the dark-colored shale overlying it. Similar whitish shales are found at several other places in Orange County, and it seems reasonable tentatively to correlate them with the silicious shales found resting on the whitish sandstone formation in the Puente Hills and in Ventura County, as previously described, and with the silicious shales which form a large portion of Point San Pedro in Los Angeles County. North of the San Joaquin Hills in Orange County, the white shale forms the bedrock throughout a large area in the valley lands, and shales of this series, grayish to brownish in color, form low cliffs along the shore-line to the east of Newport Bay. At Point San Pedro there are silicious shales which were deposited during a period of volcanic activity, for not only does eruptive rock occur there as dikes penetrating the shale, but also the shale is found interstratified with volcanic material. The clay-shales overlying the whitish shale in Orange County must be correlated with the Middle Neocene shales observed in Ventura County, in the Puente Hills, and in the City of Los Angeles. These clay-shales are the prevailing formation exposed in the southeast end of Orange County, where they form purple-colored cliffs along the shore-line. As

described in previous chapters, this formation has been identified in other localities, and fossils obtained therefrom are classified by Dr. Merriam as representing the Middle Neocene epoch. (See Table III.) These shales were classed as Pliocene in previous reports, on account of the number of living forms found among the fossils they contain. It is not surprising that a more extensive examination of this formation and of the collection of fossils from larger areas, led to the conclusion that these shales are somewhat older than they were at first supposed to be. As previously stated, the principal oil-yielding formations in the Puente Hills are situated in the lower portion of this shale formation, and probably in the upper portion of the underlying sandstone. In Newport in Orange County, shales resembling the Middle Neocene shales contain a large amount of heavy petroleum.

12.2.6. The question as to whether these shales rest conformably or non-conformably on the underlying sandstone, is an important one. The structural evidence on this point in sight at the Santiago Cañon is not very conclusive, owing to the fact that there has been much local disturbance, but such evidence as is in sight favors the conclusion that the shale rests non-conformably on, or at least overlaps, the underlying sandstone; in other words, that at least a portion of the shale was deposited when the land surface was sinking, and that the ocean, from which the sediments forming the shale were deposited, was overflowing, not only the whitish sandstone, but also the formation underlying it. In this connection, the most important evidence observed by the writer is, that, as noted between the Santiago Cañon and the Santa Ana River, there is a discrepancy between the direction of the angle of the dip of the whitish sandstone and the overlying shales, that the shale is found resting on different material in different places, and that in some places it rests on formations underlying the whitish sandstone. At Point San Pedro in Los Angeles County, silicious shales rest on eruptive and metamorphic rocks, and near the Aliso Cañon in the San Joaquin Hills, an outlier of the shales rests on rocks underlying the whitish sandstone. In the Puente Hills south of Pomona, these shales are found in close proximity to granitic rocks, and there does not appear to be any whitish sandstone intervening between the shale and the metamorphic and granitic rocks.

12.2.7. Resting on the shale is a conglomerate composed principally of granitic pebbles containing much black mica. From this conglomerate a few fossils of Middle Neocene age were obtained.* In the Puente Hills the conglomerate is much less disturbed and dips more to the west than does the underlying shale; but whether these differences are due to non-conformability or to local disturbance, coupled with the difference

*It will be noted that a conglomerate similar to that seen in Los Angeles and Orange counties is found resting on the Middle Neocene shales in Ventura County.

in the relative tensile strength of the shale and the conglomerate, it is not easy to determine. One thing, however, is certain, the difference in the character of the sediments forming the shale, and of those forming the conglomerate, indicates that these sediments were deposited under very different conditions. The change from homogeneous bodies of shale to shale interbedded with sandstone, and from that to conglomerate, tells of a gradual rise in the land surface. The massive granitic rocks which are the probable source of the pebbles forming the conglomerate are ten miles or more distant from the conglomerate at the mouth of the Santiago Cañon. This fact indicates an interval between the end of the period when the shale was deposited and the beginning of the period when the conglomerate was deposited. It is probable that the pebbles forming this conglomerate came from a land surface composed largely of granitic drift.

12.2.8. At San Juan Capistrano, in Orange County, a sandy formation was found containing fossils representing the Upper Neocene (Pliocene) epoch. (See Table IV.) In that locality the rock-exposures are insufficient to determine the relation of the Upper Neocene formations to the underlying shales. At the San Pedro Peninsula, a sandy formation containing numerous Quaternary fossils is found resting non-conformably on shales, presumably of Neocene age (see Table V), and there are diatomaceous deposits which probably belong to the same geological horizon.

12.2.9. On the low cliffs which form the shore-line of the inner bay at Newport, Orange County, there are diatomaceous shales and sandy strata, the latter being impregnated with petroleum. These formations contain numerous Quaternary fossils, and rest non-conformably on shales resembling the Middle Neocene shales previously described. As may be inferred from the foregoing pages, the hill ranges in the portion of Los Angeles and Orange counties described in this Bulletin, owe their existence mainly to the structure of the rocky formations; but their outline has been modified both by atmospheric erosion and by wave-cutting, as is evidenced by the terraces on the San Pedro Peninsula and at other places. (See Photo No. 12.)

12.2.10. Since even the recent sedimentary beds in Los Angeles County are more or less tilted, it is probable that the process by which the rocks have been folded continues in operation until the present day. A study of the western end of the San Joaquin Hills and of Point San Pedro leads to the conclusion that there have been volcanic outbursts since the deposition of the Neocene shales. Moreover, there is evidence that the bed-rocks beneath the alluvium of the valley are traversed by fissures. Thus, about a mile northwest of the village of Whittier, and at Howard Station, about 10 miles south of Los Angeles, there are deposits of sulphurous earth or decomposed rocks more or less impregnated with sulphur.

These deposits have doubtless been formed by sulphurous gases arising from fissures in the bedrock.

12.2.11. Beneath the alluvium of the valley the bedrock may be of any of the formations which have been described. There is reason to believe that throughout large areas the bedrock is of Quaternary age, for Quaternary fossils have been brought up from a depth of several hundred feet, and in one instance, from a depth of more than 1000′ in wells sunk in the valley land. (See record of well at Bell Station; also record of Green Meadow ranch well, described in Bulletin No. 11.) In some instances, natural gas has been struck in wells penetrating what appear to be Quaternary formations beneath the alluvium of the valley land. (See Marius Meyer well, also the Rosecrans gas-well.)

CHAPTER 3.

RECAPITULATION.

12.3.1. A recapitulation of the occurrence of petroleum in California, as described in this and previous bulletins, will give the reader a clearer conception as to the distribution of this mineral.

Petroleum, in the form of natural gas, oil, and asphaltum, is found at various places in the Coast Ranges and in the foothills of the Sierras in Kern County. Natural gas is also found in the Central Valley of California, and at some places in the foothills of the Sierras. The geological formations yielding petroleum in California range from the Lower Cretaceous to the Quaternary. Some idea as to geographical and geological distribution of these formations may be gathered from a brief enumeration of the localities where oil-mining has been carried on, and where, in some instances, valuable oil-fields have been developed. In the Puente Hills in Orange and Los Angeles counties and at the City of Los Angeles, the oil-yielding formations, as previously stated, belong to the Middle Neocene series. On the south side of the valley of the Santa Clara River in Ventura and Los Angeles counties, the principal oil-yielding formations may be tentatively classed as of Middle Neocene age, but the writer has not yet made a detailed examination of those districts.

12.3.2. On the north side of the valley of the Santa Clara River in Ventura County there are four oil-yielding horizons:

1. In the lower portion of the Middle Neocene series.
2. In the upper portion of the Lower Neocene series.
3. In the upper portion of the Eocene series.
4. In the lower portion of the Eocene series.

In the oil-fields north of Santa Paula in Ventura County the geological structure is so complex that there is some doubt as to the age of the rocks which really furnish the oil, but in the Ex-Mission field the oil-yielding formations probably belong to the upper portion of the Lower Neocene.

12.3.3. At Summerland in Santa Barbara County the character of the oil-yielding formations leads to the conclusion that they belong to the Middle Neocene series. The writer has been unable to procure any fossils from these formations. In the foothills bordering the San Joaquin Valley the oil-yielding formations range from the Eocene to the lower portion of the Middle Neocene. In the foothills of the Sierras east of Bakersfield the oil-yielding formations may be referred to the Middle Neocene. In the foothills of the Coast Ranges west of Bakersfield in Kern County petroleum is found in formations ranging from the Eocene to the Middle Neocene. In these oil-fields the most productive formations are in the lower portion of the Middle Neocene series, and valuable quantities of heavy oil are found in the upper portion of the Lower Neocene. At McKittrick the oil-bearing strata are of Middle Neocene age; at the Avenal and Kreyenhagen districts the oil-yielding strata are of Lower Neocene age. At Oil City, near Coalinga, remunerative oil-yielding strata are found in the lower portion of the Middle Neocene, the upper portion of the Lower Neocene, and the upper portion of the Eocene formations.

12.3.4. In the Panoche Valley in San Benito County, both the Middle and Lower Neocene formations are represented, but the writer has not made a detailed examination of that county. At the Cholame Valley in Monterey County there are oil-yielding formations of Middle Neocene age. At Moody Gulch in Santa Clara County, the age of the oil-yielding rocks has never been determined.

12.3.5. At the Tunitas and Purissima creeks in San Mateo County, oil is obtained from wells which penetrate rocks of Eocene age.

12.3.6. North of San Francisco, petroleum-yielding formations crop out along the coast at Bolinas Bay and at Point Arena; at these places the exposed rocks probably belong to the Upper Neocene series.

The Humboldt County oil-fields are less known than any in the State, but reconnaissances that have been made of these northern oil-territories warrant us in tentatively referring a large portion of the oil-yielding formations of Humboldt County to the Lower and Upper Neocene series. On Bear Creek and Sulphur Creek* in Colusa County gas and oil are found in rocks of Cretaceous age. Oil-yielding formations have also been discovered in Napa, Contra Costa, and Alameda counties. At Calleguas at the west end of the Simi Valley in Ventura County, a straw-colored oil has been found in volcanic tuff; and in the Placeritos Cañon

*See Bulletin No. 3, p. 6. See also chapter on the oil-yielding formations of Colusa County in this Bulletin.

in Los Angeles County, a light-colored oil is obtained from crystalline rocks. It is reported that oil-yielding formations have been discovered in the foothills of the Sierras in Shasta County, and near Yuma on the Colorado River.

12.3.7. At Stockton, in San Joaquin County, at the City of Sacramento, and near Tulare Lake, in Tulare County,* natural gas is obtained in remunerative quantities from wells penetrating strata of Quaternary age. At Marysville Buttes,† and near Sites,‡ in the Sacramento Valley, natural gas is found in rocks of Eocene age. There are several places in the Sacramento and San Joaquin valleys where wells are yielding sufficient natural gas to be of local value.

12.3.8. It is reasonable to suppose that the oil-fields described in this Bulletin have their counterparts in many other places in California not yet explored, for the geological formations, including the oil-measures thus far developed, form a large portion of the Coast Ranges between San Diego and Humboldt counties. From the description of the oil-yielding formations, the geological positions of which have been determined, it appears that the productive oil strata are sandstones underlying bodies of shale or clay, or interstratified with them. It may be argued that these conditions indicate natural distillation as the chief cause of the accumulation of petroleum in the oil-measures.

12.3.9. It is reasonable to infer that the petroleum, having been elaborated in the shale, may have been driven out of it by natural distillation or by pressure into inclosing or interstratified beds of sandstone. Concerning the origin of sufficient heat to produce natural distillation, it is enough to mention chemical action and the stress to which the rocks have been subjected. It is generally conceded that the principal source of petroleum is animal and vegetable organisms which have been buried in rock-forming sediments. There doubtless have been different epochs in which such organisms were particularly abundant. Thus, in California, the early Neocene appears to have been such an epoch, for during this epoch the silicious shales which form such a landmark in the geology of our Coast Ranges, were deposited, and in many places these shales are found to be made up largely of the silicious skeletons of animal and vegetable organisms, mainly microscopic. It must also be remembered that a very small percentage of petroleum originally distributed through a great thickness of strata might be driven into different zones by natural distillation; and that, at certain temperature and pressure, it would pass readily through sandstone. The upward course of the petroleum might be impeded by strata of shale, and, when the temperature decreased, the petroleum might condense in any rocks suffi-

* See Bulletin No. 3, p. 68: Quaternary fossils from gas wells in the Central Valley.

† See Bulletin No. 3, pp. 9 and 10: Description of Marysville Buttes of California.

‡ See Bulletin No. 3, pp. 6 and 7: Inflammable gas, near Sites, Colusa County.

ciently porous to afford it storage. If the shale were only partially impervious to the petroleum, the former would be more or less permeated by the latter, and fractures in the shale would give the petroleum access to overlying formations. A modification of such processes, by gas or hydrostatic pressure, would be quite sufficient to bring about a redistribution of the petroleum and the formation of secondary deposits of that mineral.

12.3.10. The following table shows the geological horizon of the oil-yielding formations in the districts which the writer has investigated:

TABLE SHOWING GEOLOGIC RANGE OF OIL-YIELDING FORMATIONS IN CALIFORNIA AS FAR AS THEY HAVE BEEN DETERMINED.

System.	Epoch.	California Equivalent.	Localities where Oil-yielding Formations are Found.
Cretaceous	Lower	Knoxville beds	Bear Creek and Sulphur Creek, Colusa County.
	Upper.		
Tertiary	Upper Eocene	Tejon	Coalinga District, Fresno County; Tunitas and Purissima creeks, San Mateo County; Sespe and Devil's Gate districts, Ventura County; Santa Ynez Mountains, Santa Barbara County.
	Lower Neocene (Miocene)	Monterey	Kreyenhagen district, Kings County; Oil City, Fresno County; Sunset oil-district, Kern County; Modelo oil-wells, Ventura County; Sulphur Mountains; Ex-Mission district, Ventura County.
	Middle Neocene* (Transition between Miocene and Pliocene)	San Pablo	Coalinga district, Fresno County; McKittrick, Sunset, and Kern River districts, Kern County; Piru, Ventura County; Los Angeles City and Elsmere Cañon, Los Angeles County; and the Puente Hills, in Los Angeles and Orange counties. Also, a large part of the oil-yielding formations of San Luis Obispo, Monterey, and San Benito counties; Summerland, Santa Barbara County (?); the oil-fields on the south side of the valley of the Santa Clara River, Los Angeles and Ventura counties (?).

*In Bulletins Nos. 3 and 11 this formation was classed as Pliocene, on account of the number of living forms found among its fossils.

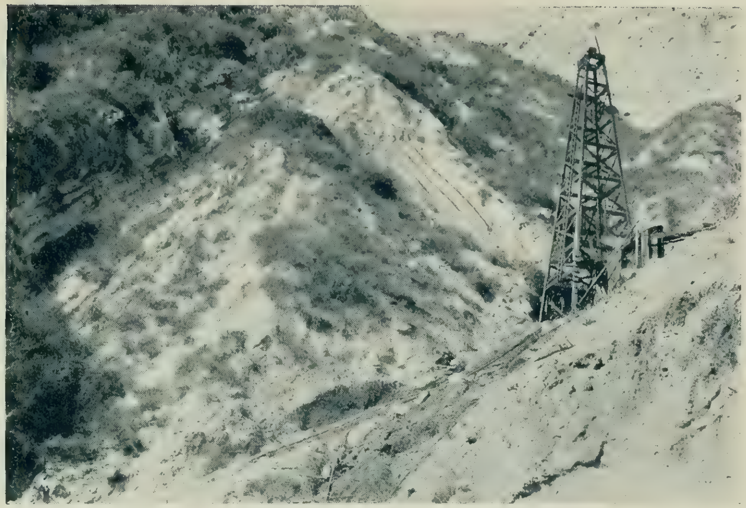


PHOTO 33. Fold in Modelo Cañon, Ventura County.

PHOTO 34. Inclined Fold, Temescal Ranch, Ventura County.

CHAPTER 4.

GEOLOGICAL STRUCTURE PERTAINING TO THE OCCURRENCE OF PETROLEUM IN CALIFORNIA.

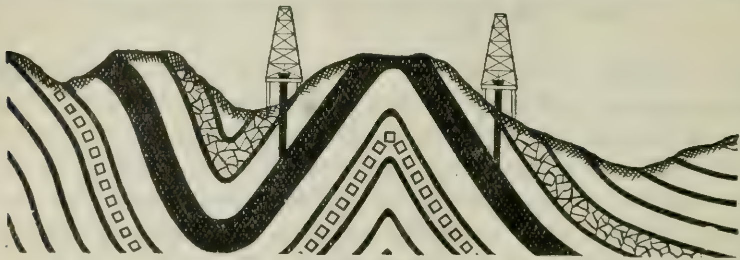
12.4.1. There are two phases of geological research upon which a right understanding of our petroleum deposits depends: (1) An investigation as to the area over which the petroleum-yielding formations extend; and (2) an investigation as to the probable course, length, and width of the oil-lines, or the lines along which remunerative wells can be obtained. With a good topographical map, the former can be successfully carried on without the expenditure of much time and labor; the latter, upon which alone a correct estimation as to the value of our petroleum deposits can be based, requires a careful study of the structural geology pertaining to the subject.

12.4.2. To those who explore the hills and mountains of the Coast Ranges there are few things more interesting than the curiously folded condition of the rocky strata. In California the student of structural geology has not to search very far before he finds natural illustrations of the types of folds he has seen in his text-books. In some parts of the world such folds are many miles in breadth, but in the Coast Ranges the conspicuous folds are generally narrow ones. These small and conspicuous folds usually constitute portions of larger folds, which, although they are more important than the small folds in the formation of hills and mountains, are not so easily detected unless a large area is carefully mapped out and studied. The small folds are, however, of great importance in determining the course and the width of oil-lines. It is in order, therefore, to speak of the more common types of folds and structural forms which are familiar to all students of geology, and to say a few words about their relation to petroleum mining.

12.4.3. *First*—The upright fold, as shown in Fig. 15. The strata forming the sides or limbs of this fold slope away at equal angles of inclination from the axis of the fold. Now, provided the structure is not complicated by faults, it is obvious that wells sunk on opposite sides of this fold, and at points equidistant from its axis, would strike the stratum of oil-sand at the same depth.

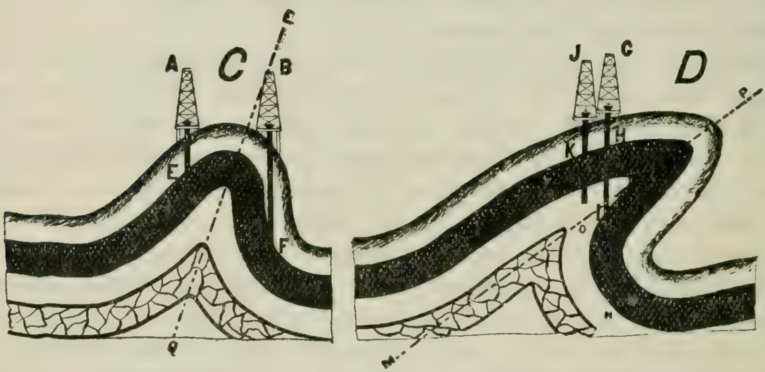
Second—The inclined fold, as shown at C, Fig. 16. In this fold the strata forming one side or limb of the fold slope away from the axis at a greater angle than do the strata forming the other side or limb of the fold. If wells were sunk on opposite sides of this fold at points equidistant from its axis, such as at points A and B, Figs. 16 and 17, it is evident that a well sunk at point A would strike the oil-sand at a much less depth than would a well sunk at point B.

Third—The overturned fold, as shown at D, Fig. 16. In this case a well sunk at point C would penetrate the oil-sand on both sides of the fold. When erosion has worn away the crown of an overturned fold, as shown at D, Fig. 17, a geological problem presents itself, which in many



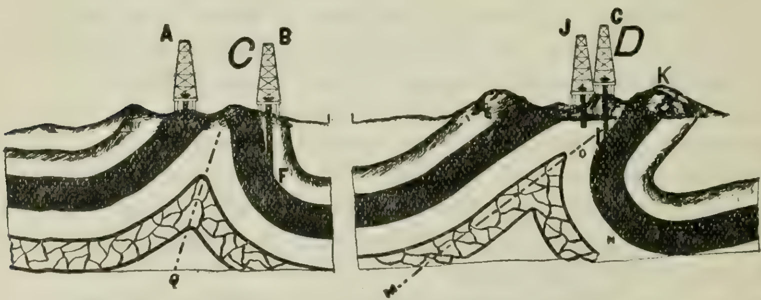
Upright Fold.

FIG. 15.



Inclined Fold. Overturned Fold.

FIG. 16.



Wells on Inclined Fold. Wells on Overturned Fold.

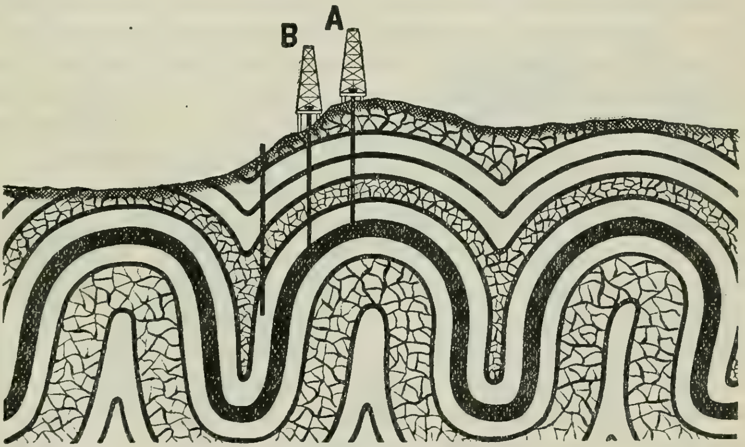
FIG. 17.

instances requires the investigation of a wide area in order to obtain a satisfactory solution.

12.4.4. Illustration D, Fig. 17, shows mistakes which are quite likely to be made by drilling on an overturned fold. If an outcrop of oil-sand had been discovered at point K, the dip at the outcrop would coincide

with OM, the axis of the fold. Unless the structure of the formation were known, it would naturally be supposed that the dip of the oil-sand stratum was fully shown by the exposed rocks at point K. If well G were drilled, the oil-sand would be struck at point I, and the oil-sand stratum would be penetrated lengthwise between I and N. This would lead to the erroneous conclusion that a very thick stratum of oil-sand had been penetrated. If well J were drilled with the intention of striking the oil-sand at O, it is obvious that the oil-sand would be missed altogether. This illustrates the advisability of exhausting all the evidence in sight concerning the structural geology of a locality before wells are located.

12.4.5. It is quite probable that in many instances the dip of strata greatly increases at short distances from anticlinal axes. Moreover, as the axis of a syncline is approached, the strata may be pushed over so that they dip backward toward the axis of the anticline, giving the fold



Fan-shaped Fold.

FIG. 18.

a fan-shaped structure, as shown on the right in Fig. 18. If oil-yielding formations were folded in this manner, it is obvious that, although the oil-sand might be struck at a reasonable depth near the axis of the anticline, as in the case of wells A and B, Fig. 18, a very short distance farther down the slope of the fold the oil-sand might plunge to so great a depth that it could not be profitably reached by the drill.

12.4.6. Photos 33, 34, and 35 illustrate the plication met with in the Coast Ranges. Photo 33 looks like an upright fold, especially at the point photographed. Investigation showed that the strata forming the side of the fold on which the derrick is situated dip at a less angle than do the strata on the opposite side of the fold. The fold is, therefore, slightly inclined. Photo 34 is a good representation of an inclined fold. Photo 35

illustrates the contortions to which rocky strata are subjected, and of which the overturned fold is a type. (See also Photos 1 and 20.)

12.4.7. A question here suggests itself as to the depth at which the rocks cease to be affected by folds. It is evident that where the axes of the folds are close together, strata inclined at a moderate angle could not extend to a great depth; but where the angle of the dip approaches the vertical, the lowest portion of the inclined strata may be deeply buried. A simple calculation shows that in the case of folds, the axes of which are 1200′ apart, other things being equal, the greatest depth attained by strata dipping at 50°, 60°, 70°, and 80°, respectively, would be: At 50°, 715′; at 60°, 1039′; at 70°, 1648′; at 80°, 3403′. In any case, there is little doubt but that the smaller folds disappear as great depth is attained, and that strata in the zone underlying them are affected by greater folds, to which the smaller folds are secondary structures.

12.4.8. It is reasonable to suppose that compressed folds do not extend to a great depth in a uniform curve, but that the rock-masses have been readjusted by reciprocal movement. Wherever there has been so much stratigraphical disturbance as is the case in the Coast Ranges, it is evident that structural conditions must be affected, not only by faults and fractures, but also by the thinning or thickening of the softer strata, on account of the compression to which they have been subjected.

12.4.9. A supposed case will illustrate the relation of anticlinal folds to oil-lines. Thus, let Fig. 19 represent oil-yielding strata as CC and OO and the inclosing rocks thrown into an anticlinal fold, the axis of which extends between points B and E. HH is the line of outcrop, or the line along which the oil-sand comes to the surface. An examination of this outcrop and a study of the geological structure of the formation would enable operators to determine a suitable point at which to sink their first well. The derricks shown in this illustration indicate that an oil-line has been developed on the east side of the fold. It will be observed that the oil-line runs parallel to, and at no great distance from, the axis of the fold.

Distance DA represents the breadth of the oil-line, which is supposed to include only two rows of wells, for east of point A the oil-sand might lie too deep to be profitably reached by the drill. If the investigations showed that the geological formation had been thrown into a fold such as that shown in Fig. 19 and an oil-line had been developed on the east side of the fold, it would be reasonable to expect the existence of a similar oil-line on the opposite or west side of the fold, and that, like the oil-line on the east side, it would run parallel to, and at no great distance from, the axis of the fold. (See Fig. 20.) On the west side of the fold the angle of the dip is less than it is on the east side. Therefore, the oil-line is wider on the west than on the east side of the fold, thus permitting more than two rows of wells to be drilled with profit.

PHOTO 35. OVERTURNED FOLD, SAN PEDRO PENINSULA, LOS ANGELES COUNTY.

Ideal section of oil-field on anticlinal fold; oil-line developed on one limb of the fold.

FIG. 19.

Ideal section of oil-field on anticlinal fold; oil-line developed on both sides of fold.

FIG. 20.

In order to further prospect the territory, well X might be deepened, and a second stratum of oil-sand discovered. It is obvious that a discovery of a second oil-sand would greatly increase the value of the territory, for not only might wells be drilled which would tap both strata of oil-sand, but remunerative wells, such as Y and Z, might be drilled and derive their oil entirely from the second oil-sand. It might be, that while one side of the fold furnished valuable oil-territory, the formations on the other side would be so crushed and broken that remunerative wells could not be obtained; or, as shown in Fig. 21, the oil-line might be cut in two by a fault, or a part of it might have slipped down to too great a depth for the oil-sand to be reached by the drill.

As previously mentioned, the dark line HH on the east side of the fold represents the outcrop of the oil-sand with seepages of oil. On the west side of the fold the slope of the hill is supposed to be covered with alluvium. The line of outcrop of any stratum is the line along which it comes to the surface.

12.4.10. In prospecting for petroleum or any other mineral the outcrop is a most important guide. Thus, supposing the black line HH to be the oil-sand, an examination of the outcropping stratum would show the direction in which the oil-sand extends, and the angle at which it dips or is inclined. Consequently, the depth at which the oil-sand could be struck by drilling at any distance from the outcrop might be calculated. When, however, the exposed rocks are situated near the axis of a fold, or the fold of which they form a part is overturned, they are by no means an infallible guide as to the prevailing angle of the dip. In locating an oil-well, the character of the fold affecting the rocks about to be prospected should be taken into account, as demonstrated by the type-folds described in this paper.

In most instances, however, only glimpses of the outcrop can be obtained. As in the case of stratum OO (Fig. 19), the oil-sand may be covered by a great thickness of overlying rock, and the existence of oil-yielding formations may be indicated only by an oil-spring, or they may have been accidentally discovered by drilling. When such buried oil-yielding formations have been discovered on any particular fold, and the position of the oil-sand with regard to the inclosing rocks has been determined, the probable course of the oil-lines may be ascertained by tracing the course of the fold. It is quite important to ascertain whether or not the oil-sand lies conformably beneath the rocks which cover it; or, in other words, whether or not the oil-sand is folded in the same way as the rocks which are exposed at the surface. In hills and mountains, however, it is more than likely that the prospector will be assisted by glimpses of the oil-sand in ravines and cañons, where the overlying rocks have been cut through by erosion.

12.4.11. There are structural conditions of the rocky strata besides

that of folding which may determine the existence and the course of oil-lines. The most important of these are faults. As there are many who may not have studied structural geology, it might not be out of place to say a few words on that subject.

Faults are breaks or displacements in the rocky strata, whereby blocks of the earth's crust have been elevated, depressed, or pushed over one another. Where only depression or elevation has taken place, they are called normal or gravity faults; where pushing over has occurred, they are called reversed or thrust faults. The fractures are occasioned by the stretching or compression of the rocky strata. In the case of thrust faults, the controlling power is the thrust or stress occasioned by the compression; and, in the case of gravity faults, it is the force of gravity.

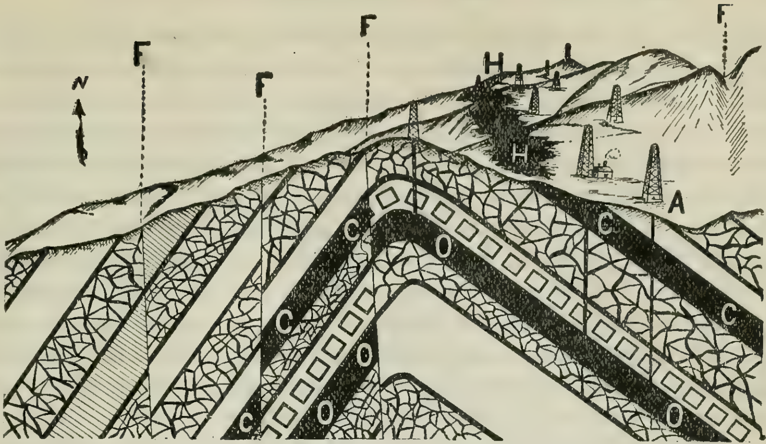
In areas of great compression, like that of the Coast Ranges, it might be supposed that all the faults would be thrust faults, but in many instances the fracture which occasioned the fault is nearly vertical to the plane of the horizon, in which case the force of gravity may control the thrust.

The faults most likely to result in the formation of oil-lines are those which have been caused by fractures extending in the direction of the strike of the formation, and which have allowed blocks of the earth's crust to slip past one another, so that they are arranged in the form of steps.

12.4.12. Let Fig. 22 represent a series of rocky strata inclosing a stratum of oil-sand, the dip being at an angle of about 30°. If well Z is 2000′ deep, the oil-sand west of this well would be too far below the surface to be profitably reached by the drill. Let us suppose that, owing to fractures at points B and D, a fault was formed by block BD slipping down, as shown in Fig. 23. When erosion has worn away the surface (see Fig. 23) two oil-lines might be formed, and the oil might be reached by wells of moderate depth between points E and B, as well as between B and D.

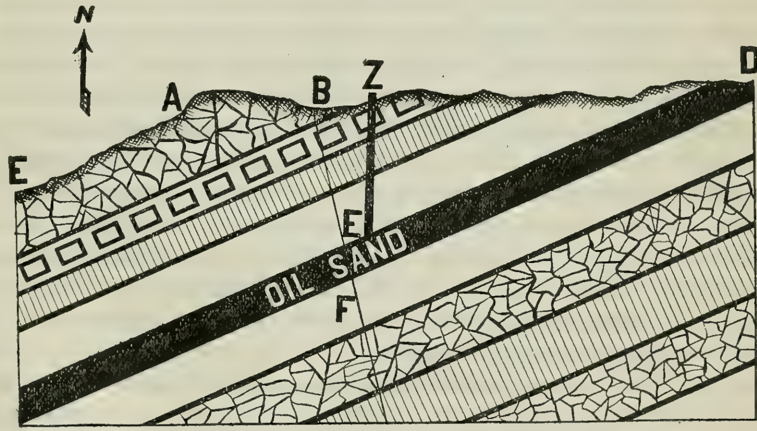
In Fig. 23 a gravity fault is used for purposes of illustration, and it will be observed that the fracture slopes toward the block which has slipped down. Thrust faults, when the fissures which formed them are nearly vertical, might produce similar results, so far as the multiplication of the oil-line is concerned; but in the case of thrust faults the fractures would slope toward the block which has been elevated. When faults are close together the rocks are likely to be so crushed that the oil-line has been destroyed.

12.4.13. Lines of geological disturbance may show faults at one point and a well-marked fold at another. Other things being equal, the question of faulting or folding is determined by the character of the rocks, the thickness of the strata, and the conditions to which they are sub-



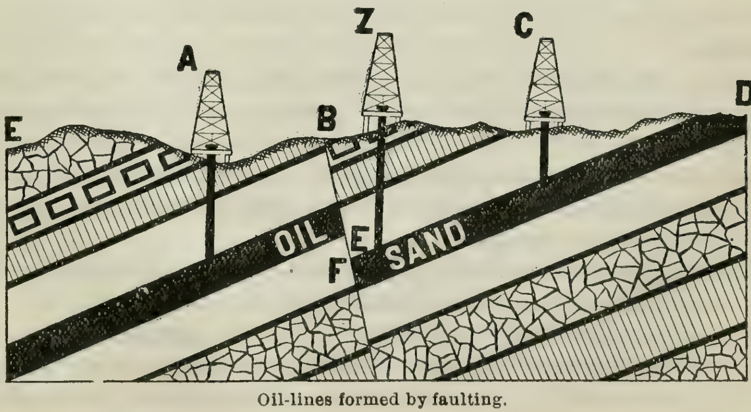
Ideal section of oil-field on anticlinal fold; one limb of the fold broken by faults.

FIG. 21.



Section showing strata inclosing oil-sand stratum.

FIG. 22.



Oil-lines formed by faulting.

FIG. 23.

jected. In the movement which occasioned the faulting or folding, deeply buried strata are more likely to be folded than to be fractured or faulted; while with less deeply buried strata the reverse is the case. In most instances beds of soft material are likely to be more crumpled and folded at acute angles than are harder rocks, but where the hard rocks are thin-bedded they are often as severely crumpled as the softer rocks.

12.4.14. In many localities the rocks are found to be affected by more than one order of folds. In most instances we find dominant folds which have controlled the prevailing strike and dip of the formation, and cross-folds which have a different strike to that of the dominant folds. At points where the cross-folds strike the axes of the dominant folds, the tendency is to form dome-like elevations, or to occasion a great complexity of structure by plication and fracture.

12.4.15. The foregoing remarks on structural geology are sufficient to indicate the structure which, in most instances, controls the course of oil-lines in a country where the formations have been much disturbed.

So far as observed, the oil-lines in the Coast Ranges are governed by structural conditions, such as are described in this paper. A continued study of the development of our oil-fields will still further show how nearly the facts disclosed by the drill conform to the recognized types of geological structure; and a record of such observations cannot fail to be beneficial to the development of the petroleum industry.

Where the rocks are closely folded, as they are in most of the oil-districts of the Coast Ranges, drillers are likely to meet with anomalous experiences, owing to faulting and shifting incidental to the rearrangement of rock-masses, and this necessitates extended observation and great care in making deductions.

12.4.16. The folds and geological structures to be seen in the hills and mountains where the rocks are exposed, do not necessarily terminate in the uplands; they also extend beneath the alluvium of the valleys. Oil-lines that have been discovered in the hills and mountains may be followed into the valleys where the rocks are covered with alluvium.

It would be expected that in districts where there has been much geological disturbance oil-lines would be broken and of irregular extent; this is found to be the case in California. In the Coast Ranges the longest unbroken oil-line yet developed is that of the Central oil-field at Los Angeles and its western extension, which constitute an oil-line more than 2 miles in length.

12.4.17. The financial risks of prospecting for oil vary greatly. Oil-prospecting propositions may be divided into two orders:

First—The "orthodox" proposition. In this case the prospectors have in view a definite oil-yielding stratum, which has proved remunerative in adjacent territory, and from which stratum they expect to obtain

their oil. Moreover, they have satisfactory geological evidence in sight that the oil-stratum they have in view forms an oil-line through the territory they are about to prospect.

Second—The "wild-cat" proposition. In this instance the prospectors have no definite oil-stratum in view which has proved remunerative in adjacent territory, or they have not satisfactory geological evidence in sight that an oil-yielding stratum, which is known to be productive in adjacent territory, forms an oil-line through the land they are about to prospect.

In prospect wells of the first order the least risk is taken where the outcrop of an oil-sand, which has proved remunerative in a certain oil-field, can be actually traced through the territory to be prospected, and the geological structure of the locality is known.

More risk, however, is undertaken where there is no outcrop of the oil-sand, although the strike and dip of a remunerative body of oil-sand in an adjacent oil-field are known, and the rocks overlying the oil-sand can be traced to the territory about to be prospected. When an oil-line has been developed on one side of a fold, under certain conditions shown in Fig. 19, and an outcrop of oil-sand has been discovered on the other side of the fold, propositions to prospect this side must be classed among the more risky "orthodox" propositions.

Most oil-mining enterprises which have for their object the development of new territory, especially when operations are conducted at a distance from any known oil-field, are "wild-cat" propositions. Some idea of the conditions regulating the amount of risk involved in such enterprises may be gathered from the following statements:

The least risky "wild-cat" proposition is the case in which the strike and dip of a remunerative stratum of oil-sand in adjacent territory have been ascertained, and, although there is no conclusive geological evidence in sight, it is found after carefully platting a map of the territory that, if the stratum of oil-sand were extended in the direction of its strike, without any material alteration of the angle of the dip, it would form an oil-line across the territory to be prospected. It is a more risky "wild-cat" proposition to prospect the side of a fold opposite to that on which an oil-line has been developed (as shown in Figs. 19, 20, 21, and 23) in cases where surface indications warrant the assumption that the same sequence of formation exists on both sides of the fold, and yet no outcrop of oil-sand has been discovered on the side about to be prospected.

It is a still more risky "wild-cat" proposition when a stratum of oil-sand has been discovered, concerning which nothing is known except that the sand gives evidence of containing oil, and a well is sunk for the first time to determine whether or not the oil-sand contains oil in remunerative quantities.

It is a much more risky "wild-cat" proposition where no outcrop of oil-sand has been discovered, but where a well has been sunk in a certain formation because it shows some irregular seepages of petroleum, or because the formation appears to be similar to that containing a remunerative body of oil-sand in other places.

12.4.18. It is well for oil-prospectors to study the risk they are about to take before expending money, and care should be taken to control sufficient territory that they may have sufficient room to develop their oil-field, in case their venture proves successful. No one should undertake the more risky forms of prospecting unless he can well afford to lose the money to be put into the enterprise.

12.4.19. In California petroleum is found in shales, limestones, sandstones, and conglomerates, and in a few instances crystalline rocks are found impregnated with it; but in nearly all of the productive wells the oil is found saturating sandy strata. In this State the folding of the rocks has brought these oil-soaked strata near the surface, and the oil-lines, or lines along which remunerative wells can be obtained, are parallel to the axes of folds, or to the lines of faulting. The oil-lines extend in breadth only a certain distance down the limbs of the folds or down the block of tilted strata, which has been isolated by faulting. The lateral extent of the oil-line is limited at its upper margin by the outcrop of the oil-sand, or by a line of geological disturbance such as a fault, or by the oil-sand being brought too close to the surface at the axis of the fold on which the oil-line is situated. On its lower margin it is limited by the dip of the formation, which carries the oil-yielding stratum to too great a depth for it to be profitably reached by the drill; or, where the oil-sand is struck below a certain depth, it may be found that water has displaced the oil.

12.4.20. As geologists and oil-men know, the dip and the strike of the oil-sand are of the greatest importance in locating the site of an oil-well, and in the case of prospect wells the dip and the strike have to be ascertained from the exposed rocks.

Many people are not familiar with geological terms, therefore it is in order to describe what is meant by the dip and the strike of a stratum of rock, and to give simple methods for determining the conditions represented by these terms.

The dip of a stratum of rock is the angle which its surface, when inclined, makes with the horizon. The strike is the horizontal direction in which a stratum of rocks extends, and is always at right angles to the dip. Therefore, if the direction of the dip is known, the strike can be readily determined.

The direction of the dip of an inclined stratum corresponds to a line drawn along the inclined surface in the direction of its greatest inclination, and is always at right angles to the strike. (See article by the writer in the "Mining and Scientific Press," Feb. 4, 1899.)

12.4.21. The following is a simple method for determining the dip of exposed strata with sufficient accuracy for practical purposes:

In Fig. 24 let P Q D C represent the surface of an inclined stratum. It is required to determine the direction in which it dips, and the angle at which it is inclined.

If a plumb-bob be suspended from a partly open rule, as shown in Fig. 24, and the open ends of the rule be turned in the direction of the dip until the plumb-line forms one side of a triangle with the two limbs of the rule, then the lower limb G H will lie in the direction of the dip; for the plumb-line will only complete the triangle with the limbs of the rule when its lower limb is placed on I K, the line of greatest inclination of stratum P Q D C. This can be seen by turning the rule so that limb G H falls on line L M or N O, neither of which is the line of greatest inclination of the stratum. It will then be seen that, while the limb G H is in either of these positions, or any other position except the one which coincides with the line I K, the plumb-line and the limbs of the rule will not form a triangle.

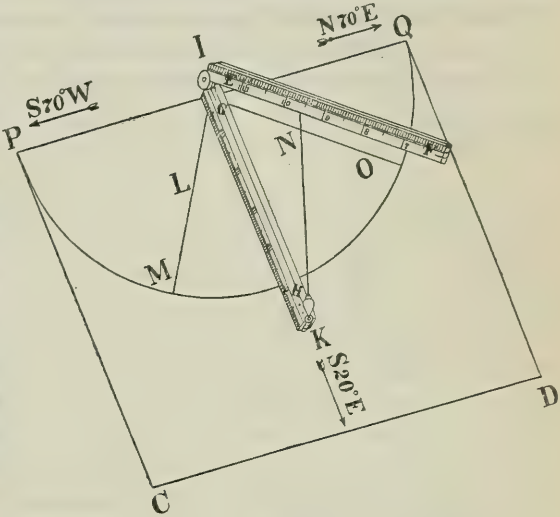


FIG. 24.
Diagram illustrating method of determining dip of exposed strata.

If E F, the upper limb of the rule, be placed in a horizontal position and the lower limb G H on I K, the line of greatest inclination, the side of the triangle formed by the plumb-line will be opposite the angle of the dip. The value of this angle may be found from the two sides of the triangle formed by a portion of the upper limb of the rule and the plumb-line.

The angle of the dip may also be ascertained with approximate accuracy by carefully laying the rule, opened as explained in the preceding paragraph, on a piece of paper, drawing the angle and measuring it with a protractor.

Some rules are furnished with a clinometer scale, by which the angle formed by the open limbs of the rule is indicated.

It will be apparent to mathematicians that, if the upper side of the triangle be considered as radius, the plumb-line will represent the tangent of the angle of the dip; and if the hypothenuse, i. e., the lower

side of the triangle, be considered as radius, the plumb-line will represent the sine of the angle of the dip.

As previously mentioned, the strike is always at right angles to the dip. Thus, in the case of stratum P Q D C, if the direction of the dip, as shown by line I K, is found to be S. 20° E., the strike will be represented by line P Q, at right angles to line I K, and the stratum will extend in a horizontal direction with a strike of S. 70° W., or N. 70° E.

Care should be taken that the surface of the stratum, the dip of which is to be ascertained, really is a bedding plane. It must be borne in mind that the bedding planes are seldom true planes, as they are subject to many inequalities.

Therefore, if possible, the dip should be estimated at several places on the same stratum, and the average of the results taken as the dip. In estimating the dip of a stratum of rock by this method, it is well to clear off a space on the surface of the stratum, and to lay thereon a board, thus getting a better surface on which to work.

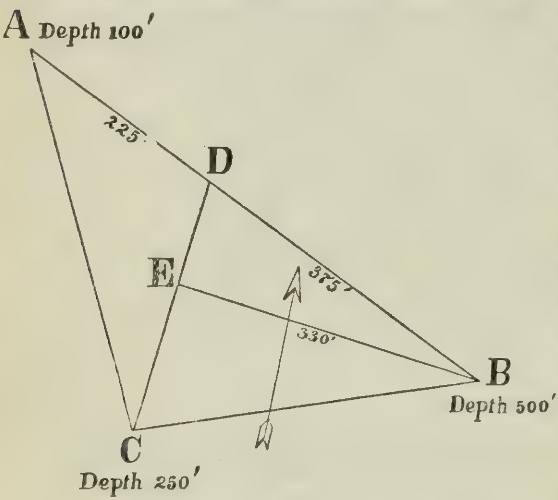


FIG. 25.
Diagram illustrating method of determining strike of oil-sand stratum.

12.4.22. When a remunerative oil-yielding stratum has been discovered, its strike and dip should be determined by drilling three wells according to the following method:

In Fig. 25 let A, B, and C be three wells in which the oil-sand has been struck at 100′, 500′, and 250′, respectively, below any datum-plane, such as a horizontal plane touching the top of well A. Draw A B, and let it represent a horizontal distance of 600′. If a point be found between wells A and B, at which the oil-sand can be struck at a depth of 250′ below the datum-plane, a line drawn from well C to that point must necessarily be drawn along the strike of the formation; and if a line be drawn at right angles to the strike of the formation and toward the deepest well, that line will necessarily be drawn in the direction of the dip of the formation. Moreover, the figure contains the elements from which the angle of the dip may be calculated.

The question is, at what point along the line A B will a well strike the oil-sand at 250′ below the datum-plane. The distance A B is 600′;

the difference in the depth of wells A and B is 400′; therefore, the grade of the surface of the oil-sand A and B is 400′ in 600′, or 2′ in 3′. Hence, wells situated along line A B and sunk to strike the stratum of oil-sand, would, if measured from the datum-plane, increase in depth as well B was approached, and the depths would be in proportion to the distance from A measured along A B.

It is required to find a point along the line A B at which the oil-sand may be struck 250′ below this line, or 150′ deeper than at A. Since the increase in depth of wells which may be sunk from the datum-plane to the oil-sand along the line A B is at the rate of 2′ in depth to every 3′ of horizontal advance toward B, the distance from well A to the required point will be to the increase of depth of well at the required point as 3 to 2, or one and one half times 150′, which is 225′. Lay off A D = 225′. As point D is 225′ distant from well A, along line A B, a well sunk at point D will strike the oil-sand at a depth of 250′ below the datum-plane. Hence, a line drawn from C to D will give the direction of the strike of the oil-sand stratum.

Or the proposition may be stated thus: The grade of the stratum of oil-sand between wells A and B is 400′ (the difference between the depth of the wells at A and B) divided by 600′ (the horizontal distance between the two wells), which gives two thirds of a foot in depth to one foot along A B. Dividing 150′ (the difference of depth of wells A and C) by two thirds of a foot, we obtain the distance 225′, which is the distance A D. Therefore, if a well were sunk at D, the oil-sand would be struck at a depth of 250′. Draw the line C D. Now, it is evident that a well sunk at any point along C D would strike the oil-sand at a depth of 250′. Hence, as before stated, the line C D is the direction of the strike of the oil-sand stratum. Moreover, any line drawn at right angles to line C D, and in the direction of the deepest well, will be drawn in the direction of the dip of the formation.

It is now required to find the angle at which the oil-sand dips, and this can be found as follows: From B draw B E at right angles to C D (the line of strike). This line E B is the direction of the dip of the formation. By measurement, we find that line E B is 330′. If a well were sunk at point E, it would strike the oil-sand at a depth of 250′ below the datum-plane. Therefore, the grade along the surface of the oil-sand in the direction of E B is 250′ in 330′; and this grade represents an angle of about 37°. If the meridian be represented by the arrow in Fig. 25, then the oil-sand penetrated by the wells A, B, and C dips S. 80° E., at an angle of about 37°, and, consequently, the strike is N. 10° E.

12.4.23. When a remunerative stratum of oil-sand has been struck and the angle at which it dips has been ascertained, as shown in the foregoing paragraphs, the distance from any of the wells, as B, to the

point at which the oil-sand ought to crop out at the surface of the ground, if it were on a level with the datum-line, can be determined. This is done by the following method:

Let Fig. 26 represent a vertical cross-section drawn through the ground-plan of Fig. 25, along line B E, and extended along the line of dip toward the outcrop. Let B *b* represent 500′, the depth of well B, and let E *e* represent the depth of a well which, if sunk at E, would strike the oil-sand at a depth of 250′, as explained in a preceding paragraph. It is required to find the point at which the stratum of oil-sand, struck in well B, ought to crop out at the surface of the ground, provided the surface were on a level with the datum-line and not covered with alluvium. Through points *b* and *e*, or the top of the oil-sand stratum, draw *b e*, and extend it until it cuts the datum-line; the point where it cuts this line is at L. If the distance between B and L be measured, it will be found to be about 660′, which is the distance between well B and the outcrop. If the surface of the ground sloped upward from the datum-line, as indicated by the outline H Y, it is evident that the oil-sand would crop out at a point above the datum-line. This point can be found by extending line *b* L till it strikes the surface. It is obvious that if the surface of the ground sloped downward from any point, such as H on the datum-line, the outcrop would be below the datum-line.

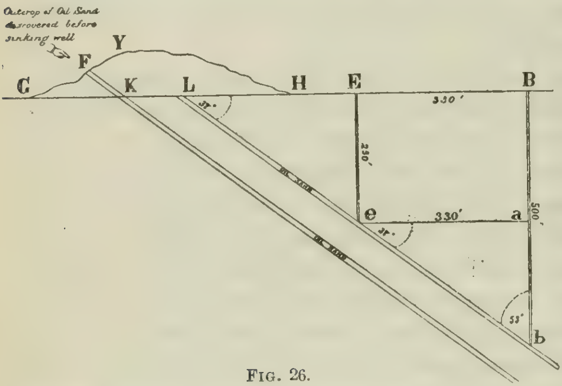


Fig. 26.

Diagram illustrating method of determining dip of oil-sand stratum.

The angle at which the oil-sand dips, and the distance from well B to the outcrop, may be found by measurement and the simple methods already given, with sufficient accuracy for practical purposes. But, if a closer estimate is desired, it can be obtained by the following trigonometrical formulas:

From the right-angled triangle *a e b* (see Fig. 26), of which $a\ e = 330'$ and $a\ b = 250'$, we have:

$$\text{Cot. of angle of dip } (a\ e\ b) = 330' \div 250' = 37^\circ\ 8'\ 48''.$$

From the right-angled triangle B L *b*, of which $B\ b = 500'$, and angle $a\ e\ b =$ angle $B\ L\ b = 37^\circ\ 8'\ 48''$, we have:

$$B\ L = 500' \times \text{cot. } 37^\circ\ 8'\ 48'' = 660'.$$

That is to say, the distance from well B to the outcrop at L, meas-

ured on the datum-plane, equals the depth of the well multiplied by the cotangent of the angle of the dip.

12.4.24. If in the first instance an outcrop of oil-sand had been discovered at point F, and well B had been sunk to strike it, then it becomes important to determine whether or not the previously discovered outcrop of the oil-sand is identical with the outcrop of the oil-sand as determined by calculation. It has been found that the angle of the dip would cause the oil-sand struck in well B to come to the surface at point L or Y. Therefore, it is reasonable to suppose that the discovered outcrop which comes to the surface at F represents a stratum of oil-sand underlying that penetrated by wells A, B, and C. (See Fig. 25.)

If an outcrop of oil-sand had been discovered at F and well B sunk and oil-sand had been struck at 500′, it would naturally be supposed that the oil-sand stratum discovered at point F had been reached. If struck a little sooner than expected, it might be accounted for on the supposition that there is some irregularity in the dip; but when three wells are sunk and the dip, calculated by the method of triangulation already explained, shows that the stratum of oil-sand struck in wells A, B, and C ought to appear at L or Y, it is presumptive evidence that the outcrop of oil-sand discovered at F is a stratum underlying that penetrated by the wells. When no outcrop of oil-sand has been discovered, it is important to find out where the outcrop ought to be in order that some idea may be had on the ground as to the width of that portion of the oil-line which lies between the well and the outcrop.

In all these calculations everything must be reckoned with reference to a common datum, which is preferably the horizontal plane passing through the highest or lowest part of the oil-field in which the calculations are made. Oil-fields should be developed by this method of triangulation, or some modification of it. In the development of an oil-field in California it is expected that many cases will occur where the calculations will not tally with the results, for the reason that there are irregularities in the formation; but taken as a whole, progress by triangulation is the only safe method of procedure.

It will be evident to mathematicians that the calculations herein set forth may be made by various formulas.

12.4.25. From the foregoing paper it will appear that, although the element of risk is inseparable from petroleum mining, it is greatly diminished by competent and careful preliminary work, consisting of:

First—A study of the structural features of the locality wherein operations are to be conducted.

Second—By following a systematic method of triangulation for determining the strike and dip of the oil-sand, and the site of new oil-wells.

When a remunerative oil-line has been discovered it should be developed gradually; and in districts where there has been much geological disturbance, it is better to limit the distance between wells to about 300′.

If oil-lines are discovered on both sides of an anticlinal fold, it is well to develop them simultaneously, by which means a correct idea as to the structure of the fold may be obtained.

By prospecting and developing territory on the lines mentioned in this paper, a few wells may be so located as to demonstrate in most instances the value of the territory; whereas wells drilled without due regard to the geological conditions of the locality demonstrate nothing more than the value of the rocks they actually penetrate, and several wells may be drilled which prove only the same fact instead of the group of facts on which the value of an oil-field depends.

12.4.26. From the foregoing discussion it is apparent that the depth of oil-wells depends on the angle at which the oil-sand dips, and the distance the wells are from the outcrop of the oil-sand, or from the axis of the fold or the fault-line on which the wells are situated. As a general statement it may be said that the most productive wells are about 1000′ in depth, some being much deeper.

12.4.27. The "life" and yield of such wells are naturally varied. Some wells are "spouters" and "start off" by flowing several hundred barrels of oil a day, but in most instances the flow subsides and the well becomes an ordinary "pumping-well." In some instances wells have "started off" with a yield of 100 bbls. or more a day by pumping, but, in the course of from two to six years, the yield has diminished to 10 bbls. or less a day. In other instances the first yield was less than 100 bbls. a day, but the rate of production was better sustained during the "life" of the well. In some oil-fields, the wells are considerably less than 1000′ in depth, but, as a rule, their yield is not so great as that of the deeper wells.

12.4.28. The cost of drilling wells varies according to the accessibility of the locality where the well is situated, and the character of the formation penetrated.

The following statement as to the cost of drilling 1000′, exclusive of the cost of casing, is a consensus of opinion obtained by correspondence with several well-known oil-producers:

Locality.	Cost of Drilling 1000′.
Los Angeles and the Kern River district	$1,000 00 to $3,500 00
The Puente Hills	3,500 00 to 7,000 00
Newhall and Territory on the north side of the valley of the Santa Clara River	5,000 00 to 7,500 00
The foothills of the Coast Ranges on the west side of the San Joaquin Valley	2,000 00 to 7,000 00

12.4.29. A review of the oil-fields in the Coast Ranges leads to the conclusion that the most favorable locality in which to drill "prospect wells" is one wherein a definite stratum of oil-sand has been discovered

in a formation belonging to a geological horizon known to include productive oil-measures in other places; preferably there should be seepages of liquid petroleum at or near the locality in which prospect wells are to be drilled, and the angle at which the oil-sand dips should not be more than 50° nor less than 10°. As stated in a previous chapter, it may be said that, in a general way, the oil-lines, or lines along which remunerative wells may be found, follow the strike of the axes of folds in the rocks, or the course of faults which have isolated blocks of strata inclosing the oil-yielding rocks. It is evident that the oil-yielding formations, in common with the other rocks of the Coast Ranges, show great geological disturbance, and the complex structure resulting therefrom gives rise to somewhat difficult geological problems. It follows that the tracing of oil-lines in this State, and the development of oil-fields, necessitate a competent knowledge of structural geology, without which the risks of oil-mining are greatly increased.

CHAPTER 5.

THE CHARACTER OF CALIFORNIA PETROLEUM, FUEL VALUE, ETC.

12.5.1. The character and fuel value of California petroleum were treated at some length in Bulletins Nos. 3 and 11, published by the State Mining Bureau. Since these bulletins are out of print, the leading facts concerning the character and fuel values of California petroleum are recapitulated in this chapter, and other data available at this writing are added hereto. It is not within the scope of this paper to enter into a lengthy discussion concerning the vexed question as to the origin of petroleum; still it is in order to give a short summary of the principal hypotheses by which the formation of petroleum has been explained. As is well known, the origin of petroleum has been accounted for in three ways:

First—By the chemical combination of inorganic matter.

Second—By chemical change, with or without natural distillation, of animal matter.

Third—By chemical change, with or without natural distillation, of vegetable matter.

The first of these hypotheses requires either that petroleum must have been originally produced by the actual combination of carbon and hydrogen then existing in the cosmical matter of which the earth is made, or that it results from chemical reactions between the substances formed from the primitive elements, such as the action of water on metallic carbides. The advocates of the first theory refer to the fact

that hydrocarbons similar to those forming petroleum have been formed in the laboratory by the action of water on metallic carbides, notably that of steam on iron carbide; also by the action of water on calcium carbide. The latter process is now one of common use in the production of acetylene gas for domestic purposes. The occurrence of bituminous matter and the occlusion of hydrocarbon gases in meteorites have also been referred to by the advocates of the first theory. They mention the fact that bitumen has been found in trappean rocks and in quicksilver deposits, and refer to the discovery of boracic acid in water accompanying springs of petroleum at the Island of Trinidad.

According to the second hypothesis, petroleum is derived from animal organisms. Supporters of this theory point out that petroleum has been manufactured in the laboratory from fish-oil soap and from fish-oils; also, that petroleum is found in limestones rich in animal remains, and that nitrogen is a constituent of many petroleums, in some forming as much as 1% of the mass.

According to the third hypothesis petroleum is derived from vegetable matter. The supporters of this theory rely on the facts that petroleum has been manufactured in the laboratory from vegetable oils; from vapors arising from boiling varnish, and by the distillation of wood, and from decaying seaweed from which air has been excluded. Some of them point out that putrefaction and decay would destroy the animal matter before it could be converted into petroleum. At first sight the objection to the animal-matter theory on the ground of rapid putrefaction seems a very serious objection, but inquiry shows that when fish are cast upon a sandy shore they are frequently buried in the sand before many tides have rolled over them. It is not the larger animals only which are to be regarded as a probable source of petroleum. The corals and the microscopic foraminifera and diatoms, the skeletons of which in some places are the principal constituents of strata hundreds of feet in thickness, must be regarded as contributing no inconsiderable quota of hydrocarbon material from which petroleum might be formed. Bearing in mind the immense amount of seaweed which in all ages has flourished in the ocean, it is impossible not to recognize this material as a probable source from which petroleum may have been formed. This view is strengthened by the fact that water accompanying petroleum in the Central Valley of California is rich in iodine. (See Bulletin No. 3.)

Since it is evident that hydrocarbons similar to those found in petroleum can be manufactured in the experimental laboratory by any one of the processes named, there does not appear to be any reason why petroleum should not be formed by any or all of such processes in the greater laboratory of nature; nor is it possible for us to figure out what reactions may take place between the hydrocarbons themselves in deeply buried strata when they are subjected to temperatures and pressures of unknown quantities.

TABLE No. 1.

Temperature at which Distillate was Cut Off.		Samples from Central Oil-Field, Los Angeles.						
		A	B	C	D	E	F	G
	Gravity of crude oil	17° B.	17° B.	17° B.	17° B.	17° B.	16° B.	16° B.
150° C.	Naphtha	Traces.	Traces.	Traces.	Traces.	Traces.	Traces.	Traces.
200° C.	Naphtha	Traces.	Traces.	Traces.	Traces.	Traces.	Traces.	Traces.
250° C.	Illuminating oil	8.0% 38° B.	7.0% 38° B.	6.0% 39° B.	9.6% 40° B.	8.0% 42° B.	1.6%	2.2%
300° C.	------	13.6% 32° B.	15.3% 29° B.	16.8% 31° B.	17.6% 36° B.	12.0% 32° B.	11.4% 32° B.	11.2% 30° B.
350° C.	Lubricating oil	3.0%	7.1% 27° B.	8.0% 27° B.	5.0% 27° B.	4.0%	3.4%	7.0% 29° B.

TABLE No. 1—Continued.

Temperature at which Distillate was Cut Off.		Mackintosh Well, Los Angeles.	Oil from Maltman Tract.	Summerland, Santa Barbara County.				Sunset Oil-District, Kern County.
				A	B	C	D	
	Gravity of crude oil	13° B.	14° B.	15° B.	17° B.	15° B.	15° B.	15° B.
150° C.	Naphtha	Traces.	Traces.	Traces.	Traces.	Traces.	Traces.	------
200° C.	Naphtha	Traces.	Traces.	Traces.	Traces.	Traces.	Traces.	0.6% 37° B.
250° C.	Illuminating oil	Traces.	1.0%	2.0%	Traces.	Traces.	Traces.	5.0% 36° B.
300° C.	------	1.6%	8.0% 31° B.	11.0% 36° B.	19.4% 34° B.	11.6% 36° B.	6.0%	8.6% 31° B.
350° C.	Lubricating oil	4.4%	9.6%	5.0% 30° B.	12.0% 26° B.	6.8% 27° B.	5.0%	5.2% 30° B.

12.5.2. A general idea of the character of the petroleum obtained in the Tertiary rocks of California may be formed by inspecting the following tables. The samples of petroleum included in Table No. 1 (page 203) are from oil-measures which, as before described, are referred to the lower portion of the Middle Neocene formations. These oils are essentially fuel oils, as is shown by their fractional constituents. The percentages given are volumetric and the temperatures are those in the head of the retort.

The samples included in Table No. 2 are from oil-measures which, as before described, are referred to the Eocene formations. These oils are of a much lighter specific gravity and contain more volatile constituents than are found in the oils included in Table No. 1.

TABLE No. 2.

Temperature at which Distillate was Cut Off.		Tar Creek.	
		A	B
	Gravity of crude oil	23° B.	23° B.
100° C.	Naphtha	----	----
150° C.	Naphtha	7.6% 60° B.	8.4% 63° B.
200° C.	Illuminating oil	11.0% 55° B.	8.0% 58° B.
250° C.	Illuminating oil	10.4% 41° B.	10.4% 45° B.
300° C.	Lubricating oil	12.4% 34° B.	14.2% 33° B.
350° C.	Lubricating oil	6.0% 29° B.	4.0%

TABLE No. 2—Continued.

Temperature at which Distillate was Cut Off.		Four Forks.	Kentuck.	Coalinga (Oil City).
	Gravity of crude oil	22° B.	25° B.	34° B.
100° C.	Naphtha	----	----	0.6%
150° C.	Naphtha	Traces.	6.0% 64° B.	32.0% 45° B.
200° C.	Illuminating oil	6.9% 52° B.	8.6% 54° B.	27.0% 38° B.
250° C.	Illuminating oil	16.8% 45° B.	10.0% 44° B.	16.6% 30° B.
300° C.	Lubricating oil	9.7% 38° B.	12.2% 36° B.	----
350° C.	Lubricating oil	6.6% 33° B.	2.5% 32° B.	12.0% 24° B.

The samples included in Table No. 3 are for the most part of a lighter gravity than the samples included in Tables Nos. 1 and 2. Samples marked A, B, and C were distilled by the late W. D. Johnston, chemist to the California State Mining Bureau. The sample from the Puente wells is from formations which, as previously described, are referred to the lower portion of the Middle Neocene series, although the

gravity of the oil suggests a source of greater age. The same remarks apply to the sample from the Pacific Coast Oil Company's wells, and also to the oils obtained at the Torrey Cañon and from the Bardsdale wells in Ventura County. The sample from Tunitas Creek is from rocks of Eocene age, and it is probable that the sample from Moody Gulch was obtained in formations belonging to a similar geological horizon.

TABLE No. 3.

	Puente Oil-Wells.		Pacific Coast Oil Company, Pico Cañon Well No. 4.	Tunitas Creek, San Mateo County.	Moody Gulch, Santa Clara County.
	Sample No. 1.	Sample No. 2.	A	B	C
Gravity of crude oil	23° B.	28° B.	40° B.	45° B.	44° B.
Temperature at which distillate was cut off:					
100° C.	----	----	9.1% 69° B.	9.9% 68° B.	9.4% 65° B.
125° C.	----	----	10.4% 59° B.	17.3% 59° B.	----
150° C.	Traces.	10.2% 61° B.	9.3% 54° B.	19.5% 54° B.	24.4% 57° B.
200° C.	15.9% 52° B.	13.5% 55° B.	13.4% 48° B.	17.2% 46° B.	17.1% 47° B.
250° C.	10.8% 45° B.	12.2% 43° B.	13.9% 41° B.	11.8% 37° B.	14.8% 39° B.
300° C.	9.3% 35° B.	10.2% 36° B.	8.3% 35° B.	6.0% 33° B.	3.6% 34° B.
350° C.	2.9% 33° B.	8.3% 34° B.	----	----	----

A scrutiny of these tables indicates that on the ground of physical composition alone there is a wide range in the products that can be manufactured from California petroleum.

With the exception of a sample of oil from the Cretaceous formations of Colusa County, all the samples of oil which have been examined by the writer showed an asphaltic base; i. e., the residuum, after the distillation of the lighter hydrocarbons, was an asphalt, or a heavy tar of asphaltic character. These asphaltic oils form asphaltum on exposure to the atmosphere.

12.5.3. The residuum from the Colusa County oil is not an asphalt; physically, it resembles the residuum from Eastern asphaltum. The Colusa County oil does not form asphaltum on exposure to the air. Two samples of the Colusa County petroleum were distilled by the writer, and their distillates compare with distillates from a sample of asphaltic oil, as follows:

Sample A, from Colusa County.

	By Volume.	Specific Gravity.
Crude oil	--------	0.982, about 12° B.
Distillate below 250° C.	1%	------
Distillate between 250° C. and 325° C.	60%	0.950, about 17° B.

Nearly all the distillates came over 300° C.

Sample B, from Colusa County.

This sample contained b. s. (sludge).

	By Volume.	Specific Gravity.
Crude oil	--------	0.9835, about 11° B.
Distillate below 280° C.	Traces	------
Distillate below 300° C.	16.250%	0.9111, about 24° B.
Distillate below 350° C.	3.122%	0.9600, about 16° B.
At a somewhat higher temperature	43.750%	0.9788, about 13° B.

Sample of Oil from Los Angeles.

	By Volume.	Specific Gravity.
Crude oil	--------	0.9534, about 17° B.
Distillate below 150° C.	Traces	------
Distillate below 200° C.	Traces	------
Distillate below 250° C.	8%	0.8330, about 38° B.
Distillate below 300° C.	13.6%	0.8653, about 32° B.
Distillate below 350° C.	3%	------

Sample of Oil from Kern River Oil-Field.

(Analysis by Thos. Price & Son, of San Francisco.)

Specific gravity of crude oil, 0.962 (15° B.).
One bbl. of 44 gals. will weigh 352.72 lbs.
Sample was free from water, clay, and sand.
1,000 volumes of the oil, on fractional distillation, yielded as follows:

Degrees.	Volume.	Specific Gravity.	Degrees B.	Weight.
240° to 300°	109	.874	30	95.26
300° to 350°	100	.896	26	89.60
From 360° gradually up to a dull red heat	134	.915	23	122.61
	140	.925	21	129.50
	143	.928	20¾	132.70
	143	.930	20½	133.00
	183	.939	19	171.83
	21	.958	16	171.83
	27	.958	16	20.01
				77.49
	1.000			960.00

Flashing point of crude oil, 400° F.

"The uniformity of the various products for a range of temperature from 360° F. to a dull red heat is a good characteristic in a fuel oil, as such oils will exhibit great regularity in burning. At a temperature of 140° C., this oil is very fluid. The calorific value of the oil is 22.985 British thermal units. The theoretical evaporation per pound of oil, at a pressure of 8 atmospheres, is $17\frac{6}{10}$ lbs. Under similar conditions, the best coals coming to this market (San Francisco) show an evaporation of from 12 to 13 lbs."

12.5.4. The ultimate analyses of samples of oil from California and the Eastern States compare as follows:

Locality where Oil was Obtained.	Specific Gravity.	Nearest Degree.	C.	H.	O.	N.	S.	By Whom Analyzed.
Oil Creek, Pa.	0.730	62° B.	82.0	14.8	3.2	....	......	Deville
West Virginia	0.840	36° B.	84.3	14.1	1.6	....	......	Deville
California	....	....	86.934	11.817	......	1.1095	......	Peckham
California	0.920	22° B.	84.0	12.7	1.2	1.7	0.4	Salathè

An examination of the foregoing table shows that in the California oils the content of carbon as compared to that of hydrogen is greater than it is in oils from Eastern States. Concerning crude oils from Los Angeles and Ventura counties, Dr. Salathè says:

12.5.5. "These crude oils, all of which carry asphalt, are held in combination with the high boiling members of the hydrocarbon series and are of a very complex constitution, which conditions render their refining exceedingly difficult. By a series of chemical reactions and fractional distillations, I have succeeded in isolating various hydrocarbons which define clearly the presence of the following hydrocarbon series:

"(*a*) Hydrocarbons of the paraffin, or fatty, series.

"(*b*) Hydrides, or hydron, additional products of the benzole series, and homologous hydrocarbons.

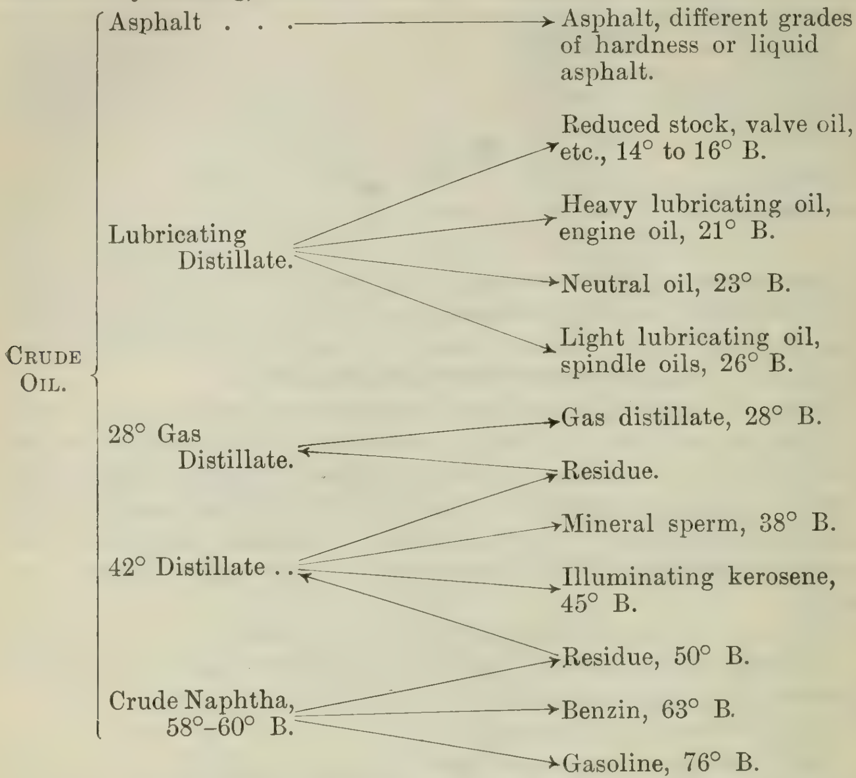
"(*c*) Pyridin and chinolin series.

"(*d*) Isomeres of the terpene series.

"(*e*) Sulphureted hydrocarbons.

"The refining of the crude California oils is not an easy task, and they require refining methods different from those practiced with Eastern or Russian oils. The complicated nature of this class of asphaltic crude oils necessitates complete elimination of all unstable hydrocarbons by inexpensive practical processes. Another great difference exists between the specific gravities of Eastern oil distillates and those of California oils. Viscosity of distillate or reduced stock being equal, the gravities are from 5° to 6° B. lower in California oil fractions than in those of Eastern oils. Flash and fire tests are from 10° to 30° F. lower in California oil distillates than in Eastern distillates of the same gravity.

"The following is a diagram of products available from California crude oil by refining, showing where re-distillation is required:



"The average yield of products from 100 bbls. of Ventura County mixed crude oils of 24° B., determined by actual running on a large scale, is as follows:

Gasoline, 76° B.	3 bbls.
Benzin, 63° B.	4 "
Kerosene, 45° B.	15 "
Heavy kerosene, 38° to 40° B.	8 "
Gas distillate, 28° B.	21 "
Light lubricating (spindle) oil, 26° B.	10 "
Neutral oil, 23° B.	12 "
Heavy neutral oil, 21° B.	6 "
Reduced stock, lubricating oil, 14° B.	5 "
Asphalt, crude	11 "
Loss	5 "

"The extraction of pyridin bases with dilute sulphuric acid should be done before the re-distillation of the distillates, as the treatment of those distillates with concentrated sulphuric acid will otherwise form certain sulpho-conjugated products, which, during the washing process with water and alkali, decompose and re-enter into solution with the refined products."

(See résumé of Original Researches and Analysis and Refining

Methods of Petroleum, mainly from the southern counties of California, by F. Salathè, Ph.D., in Bulletin No. 11 of the California State Mining Bureau.)

12.5.6. Several years ago Dr. C. P. Williams made a careful examination of certain of the lighter distillates from Southern California petroleum. His experiments showed that the samples tested were composed of the following hydrocarbons:

Name of Hydrocarbon.	Approximate Amount Contained in Sample.
Paraffin	25%
Olefin	30%
Aromatic hydrocarbons	20%
Naphthalene	25%

12.5.7. As is well known, the petroleum of the Eastern States is composed principally of hydrocarbons of the paraffin series. As previously mentioned, by far the greater portion of the California oil is used for fuel, and that in a crude state. It is the general opinion of those who use oil as fuel that, weight for weight, there is not much difference between the fuel value of oils of different specific gravities, provided the oils are clean, or a suitable allowance is made for water and other foreign substances which they contain. A portion of the oil is used for fluxing asphaltum and for the manufacture of illuminating gas, and a portion is refined. The portion refined yields crude naphtha, illuminating oil, gas distillate, lubricating oil, and asphaltum. The naphtha distilled from California oils is of special value for use in gasoline engines. Those who have made comparative tests of California and Eastern gasoline in gasoline engines claim a superiority for the California product.

12.5.8. As might be expected from the foregoing statements concerning the relative composition of petroleum from the Eastern States, and the asphaltic oil of California, illuminating oil manufactured in this State contains more carbon and less hydrogen than does illuminating oil manufactured from Eastern petroleums. The result is that when burned under similar conditions, California oil gives a more smoky flame than does oil manufactured from Eastern petroleum. This is due to the fact that it requires more oxygen to effect the complete combustion of carbon than it does to consume hydrogen.

12.5.9. As previously stated, the petroleum obtained from the Cretaceous formations of Colusa County is not an asphaltic oil. Should the petroleum from this county prove to be paraffin, and be obtained in sufficient quantities, it might yield distillates which would blend with the illuminating oil manufactured from our asphaltic petroleum and offset the excess of carbon which it contains.

A comparison of the fractional distillations of the Colusa County oil with that of the asphaltic oil from Los Angeles shows a marked discrepancy in the boiling-point and in the specific gravity of the distillates;

the excessive gravity and high boiling-point of the Colusa County oil indicate that it is a valuable lubricant.* There is no doubt that as time goes on, more use will be made of the constituents of our asphaltic oils in chemical manufacture. One use was pointed out by Dr. Salathè, who says: "The occurrence of pyridin and chinolin bases in California crude oil opens up a new resource for these products, which are largely used for the synthetical production of alkaloids, dyes, etc., and in a large measure for denaturalizing alcohol in Europe."

12.5.10. In 1896, the writer made calorimetric experiments on the fuel value of California petroleum, as stated in Bulletin No. 11 of the California State Mining Bureau, Part 4, Chapter 3. In the publication referred to, the fuel value of the petroleum, as determined by the calorimetric experiments, is compared with the fuel value of Nanaimo coal; also with the fuel value of petroleum as computed from practical working tests in locomotives on the Southern California Railroad. In Bulletin No. 11 there is also a record of calorimetric tests of the fuel value of petroleum, made by Prof. H. Stillman in the laboratory of the Southern Pacific Railroad. In 1898, calorimetric tests were made by Messrs. Jaffa and Colby of the University of California on samples of a heavy grade of petroleum from Summerland, Santa Barbara County. The fuel values, determined by these different estimates, compared as follows:

FUEL VALUES OF CALIFORNIA PETROLEUM COMPARED WITH FUEL VALUE OF COAL.

	Available Heat Units in one kilogramme	Available Heat Units in One Ton, calculated as 909 kilogrammes	One Ton of 2,000 lbs. Nanaimo Coal and equivalent in bbls. of Petroleum
Nanaimo coal	6,684	6,075,756	
Sample of petroleum, 15° B., from practical working test in locomotives on Southern California R. R.	--------	9,886,585	3.870
Sample of crude petroleum, 16.5° B., tested by Prof. Stillman	9,800	8,908,200	3.487
Sample of lubricating oil, 16° B. to 17° B., tested by Prof. Stillman	10,788	9,796,192	3.834
Sample of Los Angeles oil, 13° B., tested by W. L. Watts	10,203	9,274,527	3.630
Maximum fuel value obtained in calorimetric tests by W. L. Watts	10,381	9,436,329	3.693
Minimum fuel value obtained in calorimetric tests by W. L. Watts	9,991	9,081,819	3.554
Sample of Summerland oil (crude), tested by Messrs. Jaffa and Colby	9,688	8,806,392	3.447
Sample of Summerland oil extracted by naphtha, by Messrs. Jaffa and Colby	10,242	9,309,978	3.644

* See analysis of oil from Berryessa Valley, Napa County, Part 10, Chapter 4.

It will be observed that the practical tests in locomotives on the railroad gave a higher fuel value to the petroleum than did the calorimetric tests in the laboratory. This is due to the fact that in a furnace it is possible to obtain a more complete combustion of petroleum than of coal. In the calorimetric tests made by the writer, the petroleum was cut with gasoline, and the fuel value of the gasoline was deducted from the total calorific value. By this method, an estimate was obtained which corresponds to that by "the gasoline cut" in common use among oil-dealers for determining the amount of foreign matter in petroleum.

12.5.11. "The gasoline cut" consists in mixing, in a graduated glass, equal volumes of crude oil and gasoline. The water and foreign matter sink to the bottom of the oil, and the relative amounts of oil and foreign matter may be noted by reading the scale on the side of the graduated glass at the point of contact between the oil and residuum. The residuum at the bottom of the glass consists of earthy matter, water, and sludge, or b. s., as it is known to the trade. In many instances the sludge, or b. s., constitutes several per cent of the sample. It is usually a brown flocculent precipitate, heavier than oil and lighter than water.

The calorific value of sludge was estimated by Messrs. Jaffa and Colby at 4,149 kilogramme calories, or a little more than 40% of the fuel value of the sample of oil, which was dissolved in naphtha. Prof. T. Price, of San Francisco, who has examined samples of sludge from the California oils, states that it is composed principally of asphaltene.

12.5.12. The relative fuel value of coal and Los Angeles oil as shown by combustion in furnaces, is as follows:

The heating furnaces of Los Angeles Steel and Iron Company: One ton Wellington coal equals 2.50 bbls. of oil; for steam purposes, one ton of Wellington coal equals 3 bbls. of oil.

Los Angeles Consolidated Electric Railroad Company: Steam purposes, one ton of Wellington coal equals 3.62 bbls. of oil.

Los Angeles Court House: Steam purposes, one ton of good coal equals 3.10 bbls. of oil.

Southern California Railroad Company: Steam purposes, one ton of Nanaimo coal equals 4 bbls. of oil.

12.5.13. A careful experiment was made by the Western Sugar Refinery on the relative fuel value of Coalinga petroleum and coal, and the following record of it is from a valuable paper by E. H. Denicke of the College of Mining, University of California:

EVAPORATIVE TEST OF COALINGA OIL.

Duration of test	22 hours.
Oil burned	5,233 lbs.
Water evaporated	61,208 lbs.
Temperature of water	67° Fahr.
Steam pressure above atmosphere	90 lbs.
Actual water evaporated per pound of oil	11.69 lbs.
Equivalent evaporation from and at 212°	13.9 lbs.

It was originally intended to run this test four days continuously, but in consequence of poor combustion, due to defective arrangement of boilers, it was decided to stop at the end of twenty-two hours to make alterations. This was the first test of Coalinga oil at the Western Sugar Refinery, and was made under unfavorable conditions, but on the strength of this test the whole method of heating was changed.

STATEMENT OF COAL BURNED IN 1897,

Showing Average Evaporative Efficiency from and at 212° Fahr. Efficiency Figures from Tests Under Boiler No. 22.

Coal.	Tons.	Evaporation from and at 212° F.
Coöperative	8,986	8.88
Duckenfield	2,957	7.37
Nanaimo	9,850	7.29
Wallawah	676	7.70
Greta	9,207	7.56
Teaham	2,591	8.05
Wallsend	1,080	8.88
Total	35,347	Av. 7.88

From this table, obtained from best results, and the foregoing, there has been prepared the following table, which shows a saving of $46,012.15 per year by burning oil. But as it was based on the first test, it is safe to say that the minimum saving over coal is $60,000. This does not take into account wear and tear on boilers and general convenience:

STATEMENT OF COMPARATIVE VALUE OF OIL AND COAL (Based on the first trial test).

Coal. (Basis of 1897.)

Total bituminous coal received during 1897	35,347 tons.
Average evaporation of that coal from and at 212° Fahr.	7.88 lbs.
Total water evaporated on that basis	624,183,481 lbs.
Fireroom cost of handling that coal, reckoning 300 days at $64.26	$19,278 00
Cost of coal for this work on basis of present price—35,347 tons at $6.55	$231,522 85
Total cost of evaporating above quantity of water	$250,800 00

Oil. (Basis of $1.30 per barrel, and 13.9 evaporation.)

Oil necessary to evaporate above quantity of water	152,739 bbls.
Cost of oil, at $1.30	$198,560 70
Fireroom cost of handling that oil—300 days at $20.76	$6,228 00
Total cost of evaporating the above quantity with oil	$204,788 70
Equivalent value per ton of coal on the above basis $\frac{\$204,788.70-\$19,278}{35,347}$	$5 25
Saving on year's work by burning oil under the above conditions	$46,012 15

COMPARATIVE VALUE OF COALINGA OIL WITH DIFFERENT FUELS USED ON THE PACIFIC COAST.

Coal.	Evaporation at and from 212° Fahr.	Value per ton compared with oil at $1 30.
Coöperative Wallsend	8.88	$5 53
Nanaimo	7.29	4 44
Greta	7.56	4 60
Bulli	7.26	4 42
Wallawah	7.70	4 69

This table is made up of average coal tests and compared with oil at \$1.30 per barrel, and an average evaporation from and at 212° of 15.5 pounds. The intermittent demand for steam at the refinery does not allow them to work all of the time on the most economical methods, and instead of a test evaporation of 16.4 pounds, the average evaporation comes to 15.5 pounds. Many tests have been made at the refinery with air-blowing instead of steam, and it has been found cheaper, but as their demand for steam is subject to extreme fluctuations and as air-blowing does not "respond" as quickly as steam-blowing, it is not used under their boilers. It is now used under their kilns and gives great satisfaction. For a plant where the demand for steam is constant, it is much cheaper to use air-blowing. A different kind of a burner must be used; instead of the lip of the nozzle being 1″ wide, as in a steam burner, it must be from 2½″ to 3″ wide, according to the flame desired. Air-blowing does not give as perfect a flame as steam-blowing, because the latter heats the oil and volatilizes it. In using air to blow with, practical tests show that about 15% more air must be added than is necessary for complete theoretical combustion. From the above record it is apparent that one ton of coal having the average fuel value of the coal used in the experiment would have a fuel value equal to about 3.73 bbls. of Coalinga oil having a specific gravity of 0.852, or 34° B.

12.5.14. Mr. A. S. Cooper, California State Mineralogist, who has made a close study of California petroleum, says: "A comparison of the consumption of fuel oil with that of coal shows 3.33 bbls. of fuel oil to be equivalent to one ton of good imported coal. Figuring oil at \$1.40 per bbl., and coal at \$7.50 per ton in San Francisco, it shows the cost of oil to be \$4.66 as against \$7.50 for its equivalent in coal. Moreover, the labor required to operate with coal is far greater than with oil, in most instances being nearly double. The perfect cleanliness of fuel oil and the ease and simplicity of supply and regulation, make it a most desirable substitute for coal. As long as coal remains at \$7.50 per ton in California, it cannot be expected that oil will fall below its present price, not at least for some time to come. In the year 1899 there were 1,740,027 tons of coal imported into the State of California; to supplant this, 6,794,278 bbls. of oil will be required. As the supply becomes more permanent the uses of fuel oil will multiply."

12.5.15. Several years ago, Mr. A. M. Hunt, C.E., of San Francisco, made a very able report on the relative fuel value of petroleum and coal. As compared with Carbon Hill coal, he found that the relative evaporative equivalents were in the following proportions:

Carbon Hill coal	7.6 lbs. of water to 1 lb. of coal.
California petroleum	15 lbs. of water to 1 lb. of oil.

This gives 1.97 to 1 as the ratio of the value of petroleum to the value of Carbon Hill coal.

Mr. Hunt continues: "The following table shows the equivalent prices of oil and Carbon Hill coal, figured on the above ratio of 1.97 to 1 and taking oil as weighing 310 lbs. per barrel, which is the result of a number of determinations:

Based on Relative Evaporative Equivalents.		All Economies Considered.
Oil, per bbl.	Coal, per ton.	Coal, per ton.
$1 00	$3 66	$3 30
1 10	4 03	3 62
1 20	4 40	3 95
1 30	4 77	4 29
1 40	5 14	4 61
1 50	5 51	4 94
1 60	5 87	5 27
1 70	6 23	5 61
1 80	6 59	5 94
1 90	6 95	6 27
2 00	7 21	6 60

"The third column is figured on the basis of the statements made by Dr. Charles B. Dudley in his lecture before the Franklin Institute. He gives the relative evaporating powers of oil and coal as 1.75 to 1, and then remarks as follows:

" 'There are certain chances for economy in burning oil that do not occur with coal. Of these, there have been pretty well worked out, as just stated, economy in handling coal and ashes, and economy in repairs. The amount of these has been obtained in dollars and cents, and is, perhaps, best expressed by saying that, taking all ascertained economies into account, a pound of petroleum is as good as two pounds of coal.' "

12.5.16. The only places where natural gas assumes sufficient importance to be treated as a factor in the mineral statistics of the State are at Stockton, in San Joaquin County, and the City of Sacramento. The yield of natural gas at Stockton during the last three years has been:

	Cubic Feet.	Value.
For 1897	63,920,000	$62,657 00
For 1898	74,424,650	74,424 00
For 1899	102,960,000	84,880 00

In the City of Sacramento the amount of natural gas produced has been as follows:

	Cubic Feet.	Value.
For 1898	12,000,000	$10,000 00
For 1899	12,000,000	10,000 00

12.5.17. In 1893, the writer made a careful investigation as to the fuel value of the natural gas at Stockton. Its fuel value as compared with that of coke and Nanaimo coal showed as follows:

2,000 lbs. coke, carrying 10% ash = 42,500 cubic feet of gas.
2,000 lbs. Nanaimo coal = 38,800 cubic feet of gas.

As stated in Bulletin No. 4 of the California State Mining Bureau, the absolute value of natural gas is considerably in excess of its calorific value. In the Eastern States, the use of natural gas, instead of solid fuel, has been found to effect a saving of nearly 50%, in addition to that arising from the greater cheapness of gas as compared with coal. This economy results from a saving in labor and wear and tear of plant, and from the fact that a more uniform temperature can be secured by the use of gas than by the use of solid fuel.

CHAPTER 6.

REVIEW OF THE PETROLEUM INDUSTRY IN CALIFORNIA.

12.6.1. The existence of petroleum in California has been known for many years. From time immemorial the California Indians used this mineral, in the form of asphaltum, for various purposes. In the early history of the State, the Catholic fathers utilized it for roofing their missions and other buildings.

It is said that in 1855 or 1856, Andreas Pico distilled petroleum on a small scale for the San Fernando Mission. He obtained his crude oil from Pico Cañon near Newhall, in Los Angeles County; and he was probably the first refiner of petroleum in this State. In 1856, a company commenced work at the La Brea ranch in Los Angeles County, and tried to refine the crude oil. In 1857 an attempt was made to produce illuminating oil from crude petroleum, at Carpinteria, in Santa Barbara County; and there are records of similar attempts having been made in other localities previous to 1860, but they were not successful.

12.6.2. The first scientific report on petroleum in California was made by Prof. B. Silliman, who published his researches in 1865. He spoke favorably of the possibility of obtaining petroleum in remunerative quantities in this State, and gave the results of his experiments on the fractional distillation of California petroleum.

12.6.3. The next decade was marked by a considerable oil excitement in California, and a great many companies were formed for the purpose of petroleum mining, and for distilling crude oil.

In most instances, these companies did not meet with success, but it must be remembered that the pioneer oil-miners did not have the drilling machinery of the present day, and that they only possessed a very

limited knowledge concerning the geological conditions pertaining to the occurrences of petroleum deposits.

12.6.4. The pioneer distillers appear to have expected that by the fractional distillation of California petroleum they would obtain products similar to those resulting from the fractional distillation of the petroleum found in the Eastern States, but they were disappointed. It is not surprising that in the course of years the smaller operators became merged in larger concerns.

12.6.5. The most remarkable feature in the recent history of the petroleum industry in California is the development of the Los Angeles oil-field; of the Summerland oil-field, in Santa Barbara County; of Coalinga, in Fresno County; and of the Kern River, the Sunset, and the McKittrick districts, in Kern County. A historical sketch of these districts will be found elsewhere in this Bulletin.

12.6.6. In 1887, when the State Mining Bureau made a reconnaissance of the petroleum industry of California, the only companies actually engaged in petroleum mining were: The Pacific Coast Oil Company, in Pico Cañon; the Puente Oil Company, in the Puente Hills, Los Angeles County; the Hardisson & Stewart Oil Company (subsequently incorporated as the Union Oil Company of Ventura County), and McPherson & Co., in Moody Gulch, in Santa Clara County.

12.6.7. In July, 1900, there were about 250 companies producing oil in California, about 1590 producing wells, and about 470 prospect wells.

During the last decade there has been a steady increase in the amount of petroleum produced in California, as is shown by the comparative statement at the end of this chapter.

12.6.8. The first refinery that can be considered a commercial success was that of the California Star Oil Company, which was situated near Newhall, in Los Angeles County, and managed by T. H. Scott. Subsequently, refineries were erected at Alameda, by the Pacific Coast Oil Company, and at Santa Paula by the Union Oil Company. At the present day there are refineries at Los Angeles, Chino, Ventura, Alameda, Terminal Island in Los Angeles County, and at the Sunset oil-district in Kern County; also at Oleum in Contra Costa County, to which place the refinery of the Union Oil Company has been removed.

12.6.9. The following is a comparative statement showing the growth of the petroleum industry in California, from statistics compiled by Chas. G. Yale, statistician of the California State Mining Bureau:

County.	1897.		1898.		1899.	
	Product.	Value.	Product.	Value.	Product.	Value.
Fresno	70,140	$70,840	154,000	$154,000	439,372	$439,372
Kern			10,000	10,000	15,000	13,500
Los Angeles	1,327,011	1,327,011	1,462,871	1,462,871	1,409,356	1,409,356
Orange	12,000	12,000	60,000	60,000	108,077	108,077
Santa Barbara	130,136	130,136	132,217	112,549	208,370	191,288
Santa Clara	4,000	10,000	3,000	6,000	1,500	3,000
Ventura	368,282	368,282	427,000	571,000	496,200	496,200
	1,911,569	$1,918,269	2,249,088	$2,376,420	2,677,875	$2,660,793

PETROLEUM.

Year.	Bbls.	Year.	Bbls.
Prior to 1876	175,000	1888	990,333
1876	12,000	1889	303,220
1877	13,000	1890	307,360
1878	15,227	1891	323,600
1879	19,858	1892	385,049
1880	40,552	1893	470,179
1881	99,562	1894	783,078
1882	128,636	1895	1,245,339
1883	142,857	1896	1,257,780
1884	262,000	1897	1,911,569
1885	325,000	1898	2,249,088
1886	377,145	1899	2,677,875
1887	678,572		

Total 14,893,879 bbls.

TABLES OF

FOSSILS REFERRED TO IN THIS BULLETIN.

The fossils mentioned in the following tables have been identified and classified by Dr. J. C. Merriam, of the University of California.

The numbers given in Table I refer to the following localities:

No.	Station.	Sketch-Map. Fig.	Character of Formation.	Locality.
16	--------	--------	Calcareous stratum in shale----	Cañon near Black Star Coal Mine, Santa Ana Mountains.
18, 25	--------	--------	Coal measures------------------	Abandoned coal mine (4 miles S. of Corona), Sec. 12, T. 4 S., R. 6 W., S. B. M., north slope of Santa Ana Mountains.
21	--------	--------	Calcareous stratum in sandstone.	About 5 miles S. W. of Corona, north slope of Santa Ana Mts.

TABLE I.

Cretaceous and Eocene.

	Santa Ana Mountains, South Side.	Santa Ana Mountains, North Side.		
	16	18	21	25
Acteonella (aff.) oviformis	----	----	x	----
Arca (aff.) brewerianus	x	----	----	----
Astarte tuscana	x	----	----	----
Avicula (aff.) pellucida	x	----	----	----
Cinulia mathewsoni	----	x	----	----
Dentalium (?)	----	----	----	x
Dentalium stramineum	----	x	x	----
Dosinia inflata	x	----	----	----
Indet. New	----	x	----	----
Indet. Probably new	x	----	----	----
Notica sp.	----	x	----	----
Nucula truncata	----	x	----	----
Ostrea (?)	----	----	----	x
Pectunculus veatchii (?)	x	----	----	----
Tellina (?)	----	----	----	x
Trigonia sp. indet.	x	----	----	----
Turritella sp.	x	----	----	----
Venus sp.	x	----	----	----

The numbers given in Table II refer to the following localities, as shown on the accompanying sketch-maps:

No.	Station.	Sketch-Map. Fig.	Character of Formation.	Locality.
6	--------	G	Whitish sandstone	Piru Creek, Ventura County.
7	--------	--------	Shale underlying conglomerate	South side of San Felician Creek, Ventura County.
12, 22, 23	550	B	Whitish sandstone formation	Santiago Cañon.
20	551	B	Lower portion of whitish sandstone formation.	Santiago Cañon.
24	--------	--------	Whitish sandstone formation	S. E. cor. Sec. 12, T. 4 S., R. 6 W., S. B. M., south slope of Santa Ana Mountains.
31	--------	F	Whitish sandstone formation	S. Joaquin Peak, Orange County.
32	--------	M	--------	Tar Cañon, Avenal oil-field, Kreyenhagen district, Kings County.

TABLE II.

Miocene or Lower Neocene (California equivalent: Monterey Group).

	Santiago Cañon.	Piru Creek and Vicinity.	San Joaquin Valley.
Ostrea tayloriana. Cited as Miocene by Gabb	----	6	----
Fiscus sp. indet. Probably new	----	7	----
Ostrea sp. indet.	12	----	----
Pecten n. sp.	12	----	----
Balanoid barnacle	20	----	----
Cardium sp.	20	----	----
Shark's tooth	20	----	----
Ostrea sp.	22	----	----
Turritella ocoyana (?)	22	----	----
Zirphæa sp.	22	----	----
Turritella ocoyana	23	----	32
Turritella variata	23	----	----
Mytilus sp. (?)	24	----	----
Ostrea	24	----	----
Turritella ocoyana	24	----	----
Pecten, like cerrosensis. Possibly new	31	----	----
Pecten n. sp.	31	----	----

The numbers given in Table III refer to the following localities, as shown in the accompanying sketch-maps:

No.	Station.	Sketch-Map. Fig.	Character of Formation.	Locality.
1, 7			Light-colored shale underlying conglomerate.	San Felician Creek, Piru, Ventura County.
2		G	Conglomerate	Five miles N. E. of Camulos, Ventura County.
3		G	Fine conglomerate and coarse sandstone.	One mile N. of Camulos, Ventura County.
4		G	Coarse conglomerate	One mile N. of Camulos, Ventura County.
8		G	Conglomerate	Mt. Olivette, Piru.
33		G	Conglomerate	East side of Piru Creek, near R. R. bridge.
15	540	B	Conglomerate	Foothills, Santa Ana Mts.
29			Sandstone and shale	T. 3 N., R. 17 W., S. B. M., Simi Valley, Ventura County.
30	25	A	Calcareous stratum in bituminous shale.	Brea Cañon, Puente Hills.
37, 38, 39		A	Shale and sandstone immediately underlying conglomerate.	About one mile E. of Chandler wells, Puente Hills.
40		A		Bank of creek about one mile N. of Chandler wells, Puente Hills.

TABLE III.

Middle Neocene (California equivalent: San Pablo Group).

	Puente Hills.				Piru Creek and Vicinity.					Other Localities
	15	30	38	40	1	2	3	4	33	
Arca n. sp. (*a*)	x	x				x		x		
Arca (cf.) sulcicosta		x								
Acila castrensis								x		
Balanoid casts	x									
Bittium asperum (?)		x								
Bison, horn of, n. sp.				x						
Bulloid n. sp.							x			
Cancellaria n. sp. (*a*)			x			x				
Cancellaria n. sp. (*b*)		x	x							
Cardium sp. indet.						x				
Chlorostoma sp.							x			
Chrysodomus n. sp. (*a*)	x					x				
Chrysodomus n. sp. (*b*)		x	x				x	x		

TABLE III—Continued.

	Puente Hills.				Piru Creek and Vicinity.					Other Localities
	15	30	38	40	1	2	3	4	33	
Chrysodomus (cast) sp. indet.									x	
Chrysodomus sp. indet.		x								
Clementia subdiaphana							x			
Clementia subdiaphana (?) cast								x		
Conus sp. indet. Probably new			x							
Conus californicus (?)									x	
Conus californicus		x				x				
Conus (cast) sp. indet.							x			
Corbula n. sp.							x			
Crepidula sp. indet.			x							
Dentalium sp. indet. Possibly new		x								
Dosinia sp. ponderosa (?)							x			
Dosinia sp.		x								
Drillia sp. Probably new			x							
Echinarachinus, near excentricus					x					
Fish vertebræ					x					
Fusus ambustus								x		
Hinnites, near giganteus. Possibly new			x							
Indet. Probably new								x		
Indet. Probably new									x	
Indet. Possibly new							x			
Indet. New		x								
Indet. Probably new									x	
Leda cælata						x	x			
Lucina sp.		x								
Lucina sp. Probably new						x				
Lucina nuttalli		x								
Lucina richthofeni		x								
Lutricola alta (?)								x		
Macoma, near secta					x					
Macoma secta						x				
Mammal bones (fragments)						x				
Mangelia (conf.) variegata		x								
Mangelia sp. Probably new							x			
Muricidea incisa		x								
Nassa californica						x				
Nassa indet.					x					
Nassa perpinguis		x								
Natica sp. indet.						x				
Natica (Lunatia) lewisii	x						x	x		
Natica (Neverita) recluziana		x								
Natica (Neverita) (aff.) recluziana			x							
Nucula n. sp.								x		
Nucula sp. Probably new							x			

TABLE III—Continued.

	Puente Hills.				Piru Creek and Vicinity.					Other Localities
	15	30	38	40	1	2	3	4	33	
Olivella bœtica		x								
Operculum, probably of Pachypoma n. sp. (*a*)	x									
Ostrea sp. indet. (*a*)		37								
Ostrea sp. indet. (*a*)		39								
Ostrea sp., like (*a*)					8					
Ostrea sp.		x								
Ostrea veatchii (?)								x		29
Ostrea veatchii (?)								x		
Pachypoma n. sp. (*a*)						x				
Pachypoma, probably n. sp. (*a*)					x					
Patelloid sp. indet.									x	
Pecten cerrosensis (?)							x	x		
Pecten indet.					x					
Pecten meekii					x					
Pecten indet.			x							
Pecten sp.		x								
Priene oregonensis								x		
Priene (aff.) oregonensis			x							
Ranella californica			x							
Solen indet.									x	
Solen sicarius		x			x					
Tapes sp. indet.									x	
Tapes tenerrima		x								
Trochita n. sp.		x								
Trochita sp. indet.									x	
Trochita sp. indet.			x							
Turritella n. sp. (*a*)						x				
Turritella cooperi		x								
Venericardia borealis		x								
Vola sp. indet.									x	
Yoldia lanceolata							x			

The fossils in Table IV were obtained from a shallow well at San Juan Capistrano, Orange County:

TABLE IV.

Pliocene or Upper Neocene (California equivalent: Merced Group).

Arca (cf.) sulcicosta.
Crepidula excavata (?).
Indet. Possibly new.
Indet. Possibly new.
Nassa mendica.
Natica (near clausa).
Ostrea sp. Probably new.
Leda sp. Probably new.
Turritella cooperi.
Venericardia borealis.
Vola sp. indet.

The numbers in Table V refer to the following localities, as shown in the accompanying sketch-maps:

No.	Station.	Sketch-Map. Fig.	Character of Formation.	Locality.
5			Auriferous conglomerate	Cook Gold Mine, San Felician Creek, Ventura County.
9, 10		F	Upper oil-sand and sandstone	West side of inner bay, Newport, Orange County.
14, 19		F	Diatomaceous shale & sandstone	Newport, Orange County.
32			From a depth of between 920′ and 1320′.	In a well at Bell Station, Terminal R. R., L. Angeles County.
34		E	Sandstone	Shore-line, San Pedro.
35		E	Lower stratum of sandstone	Dead Man's Island, San Pedro.
36		E	Upper stratum of sandstone	Dead Man's Island, San Pedro.
26			From a depth of 496′	In a well on a ranch of L. Pelanconi, Sepulveda Station, Los Angeles County.

TABLE V—Quaternary Fossils.

	Newport Bay.				San Pedro Peninsula.			Other Localities
	9	10	14	19	34	35	36	
Amiantis callosa								32
Amycla carinata					x	x	x	
Amycla tuberosa						x		
Anomia sp. indet.								32
Anomia lampe			x					
Bittium asperum		x						
Bittium asperum							x	
Bryozoan remains	x							
Cardium sp. indet.					x			
Cardium panamense			x					
Chama sp.			x					
Chama sp.						x		
Chione simillima			x	x		x		
Chione succincta			x					
Chlorostoma funebrale					x			
Clementia subdiaphana						x		
Conus californicus					x		x	
Crepidula adunca	x				x			
Crucibulum spinosum			x					
Cryptomya (aff.) californica							x	
Cryptomya californica					x			
Cumingia californica						x	x	
Dentalium preposium						x		
Drillia sp.						x		
Drillia (cf.) torosa					x			
Drillia (cf.) moesta					x			
Echinoid plates (E. excentricus?)								32
Equus hoof								26
Equus tooth								5
Fusus ambustus					x			
Indet.	x							
Lucina borealis						x		

TABLE V—Continued.

	Newport Bay.				San Pedro Peninsula.			Other Localities
	9	10	14	19	34	35	36	
Lucina californica	x	----	----	----	----	x	----	----
Lucina nuttalli	----	----	----	----	----	x	x	----
Macoma inquinata	x	----	x	----	x	x	x	----
Macoma nasuta	----	----	----	----	x	----	----	32
Monoceros engonatum	x	----	----	----	x	----	----	----
Myurella (aff.) simplex	----	----	----	----	----	----	----	32
Nassa cooperi	----	----	----	----	x	x	----	----
Nassa fossata	x	----	----	----	x	x	x	----
Nassa mendica	----	----	----	----	x	----	x	----
Nassa perpinguis	x	----	----	----	x	x	x	----
Natica (Neverita) recluziana	----	----	----	x	x	----	----	----
Natica (Lunatia) lewisii (?)	----	----	----	----	x	----	x	32
Ocinebra interfassa (?)	----	----	----	----	----	34	----	----
Olivella biplicata	x	----	----	----	x	x	x	----
Olivella bœtica	----	----	----	----	x	----	----	32
Olivella intorta	----	----	----	----	----	----	x	----
Ostrea sp.	----	----	x	----	x	x	----	----
Pecten æquisulcatus	----	----	x	----	----	x	----	----
Pecten caurinum (?)	----	----	----	----	----	x	x	----
Pecten sp.	x	----	----	----	----	----	----	----
Petricola carditoides	x	----	----	----	x	----	x	----
Pholadidea (aff.) ovoidea	----	----	----	----	x	----	----	----
Placunanomia macroschisma (?)	----	----	x	----	----	----	----	----
Platyodon cancellatum	----	x	----	----	----	----	----	----
Pomaulax undosus (operculum)	----	----	x	----	----	----	----	----
Pomaulax undosus	----	----	----	x	----	----	----	----
Raeta undulata	----	----	----	----	----	----	----	32
Saxidomus gracilis	----	----	----	----	----	----	x	----
Saxidomus gracilis (?)	----	----	----	----	----	x	----	----
Schizothærus nuttalli	----	----	----	----	x	----	----	----
Serpulorbis squamigerus	----	----	----	----	----	----	x	----
Solecurtus californianus	----	----	----	----	----	x	----	----
Solen sicarius	----	----	----	----	----	x	----	----
Standella (aff.) planulata	----	----	----	----	x	x	x	----
Surcula carpenteriana	----	----	----	----	x	----	----	----
Tapes staminea	x	----	x	----	x	x	x	----
Tellina bodegensis	----	----	----	----	----	----	x	----
Tornatella sp.	----	----	----	----	----	----	----	32
Turritella cooperi	----	----	----	----	x	x	----	----
Turritella cooperi var. nov.	----	----	----	----	----	----	x	----
Turritella jewettii	----	----	----	----	----	----	x	----
Venericardia borealis	----	----	----	----	----	----	x	----
Zirphæa orispata	----	----	x	----	----	----	----	----

INDEX.

F

G

H

I

K

O

*For wells in Los Angeles, Summerland, and Kern River oil-fields, see lists on pages 63, 103, and 115 respectively.

0

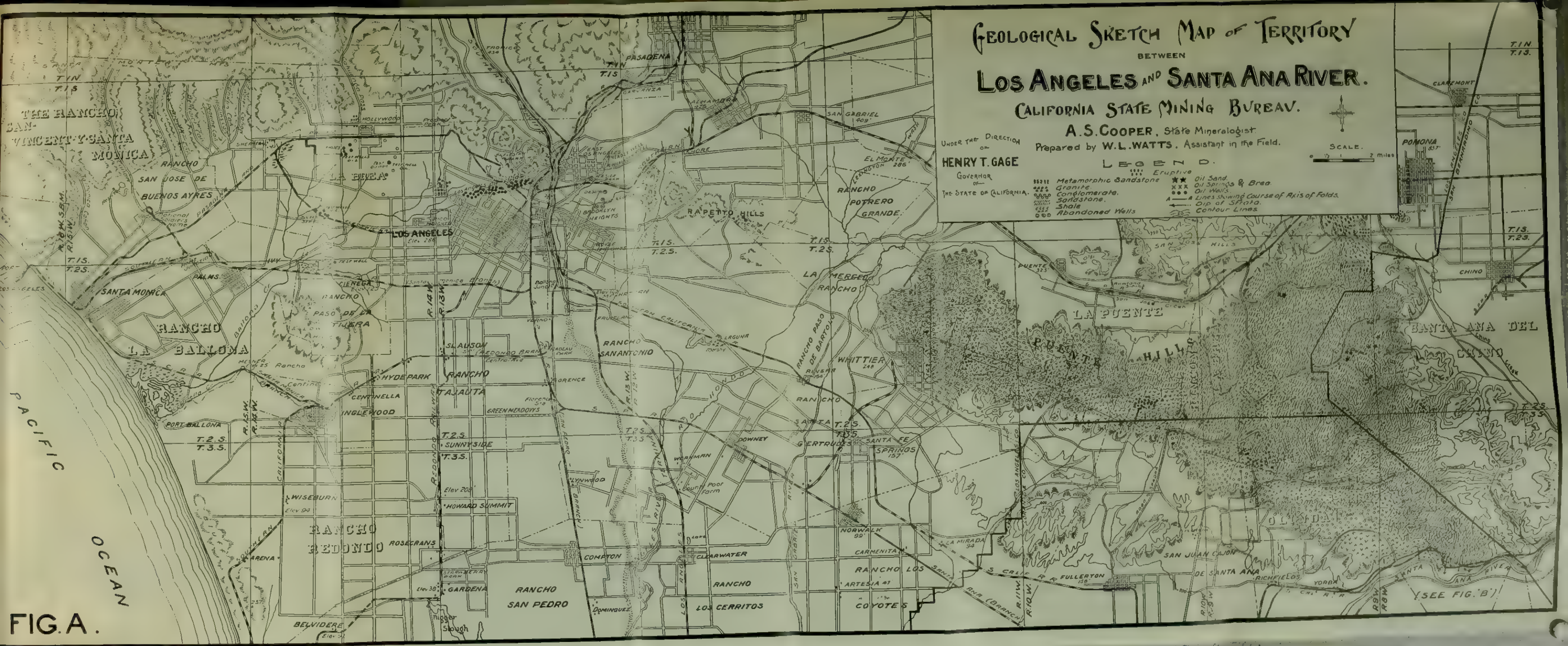

GEOLOGICAL SKETCH MAP OF TERRITORY
BETWEEN
LOS ANGELES AND SANTA ANA RIVER.
CALIFORNIA STATE MINING BUREAU.
A. S. COOPER, State Mineralogist.
Prepared by W. L. WATTS, Assistant in the Field.
UNDER THE DIRECTION OF
HENRY T. GAGE
GOVERNOR OF THE STATE OF CALIFORNIA.
LEGEND.
Eruptive
Metamorphic Sandstone
Granite.
Conglomerate.
Sandstone.
Shale
Abandoned Wells
Oil Sand.
Oil Springs & Brea.
Oil Wells.
Lines showing Course of Axis of Folds.
Dip of Strata.
Contour Lines.
SCALE.
0 1/2 1 2 miles
PACIFIC OCEAN
THE RANCHO SAN VICENTE Y SANTA MONICA
RANCHO SAN JOSE DE BUENOS AYRES
LA BREA
LOS ANGELES
PASADENA
ALHAMBRA
SAN GABRIEL
EL MONTE
HOLLYWOOD
SANTA MONICA
PALMS
RANCHO LA BALLONA
RANCHO PASO DE LA TIJERA
RANCHO REDONDO
RANCHO TAJAUTA
RANCHO POTRERO GRANDE
RAPETTO HILLS
LA MERCED RANCHO
RANCHO SAN ANTONIO
RANCHO PASO DE BARTOLO
RANCHO SANTA GERTRUDES
RANCHO SAN PEDRO
RANCHO LOS CERRITOS
RANCHO LOS COYOTES
LA PUENTE
PUENTE HILLS
SAN JOSE HILLS
SANTA ANA DEL CHINO
WHITTIER
HYDE PARK
CENTINELLA
INGLEWOOD
PORT BALLONA
SUNNYSIDE
HOWARD SUMMIT
WISEBURN
ROSECRANS
GARDENA
COMPTON
DOWNEY
NORWALK
SANTA FE SPRINGS
LA MIRADA
FULLERTON
CLEARWATER
ARTESIA
CARMENITA
SAN JUAN CAJON DE SANTA ANA
RICHFIELD
YORBA
POMONA
CHINO
CLAREMONT
PUENTE
BELVIDERE
DOMINGUEZ
SANTA ANA RIVER
(SEE FIG. B)

FIG. A.

Wells

Whitt
Wrigl

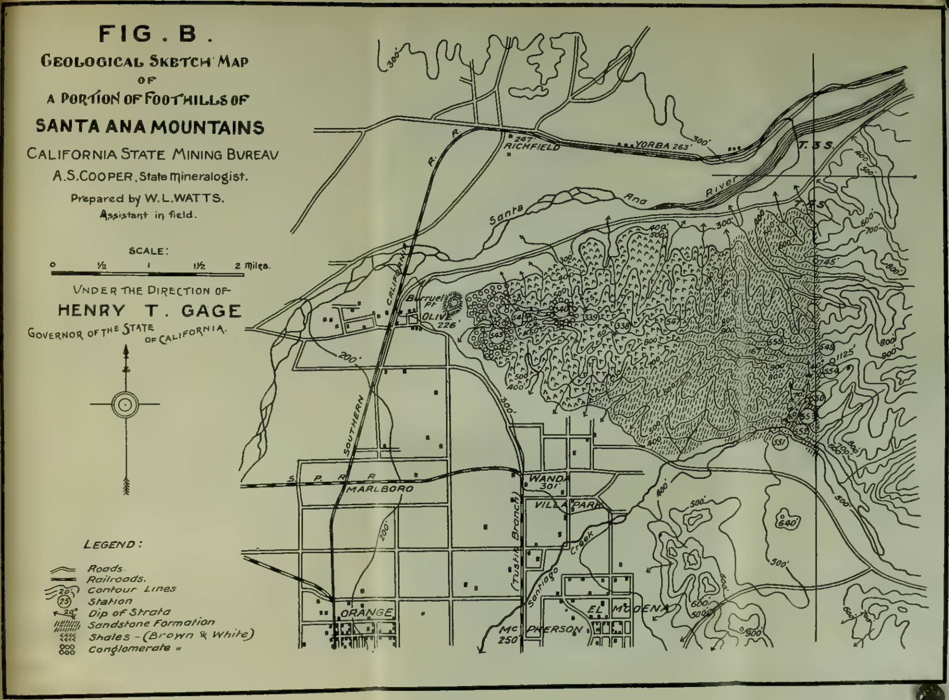
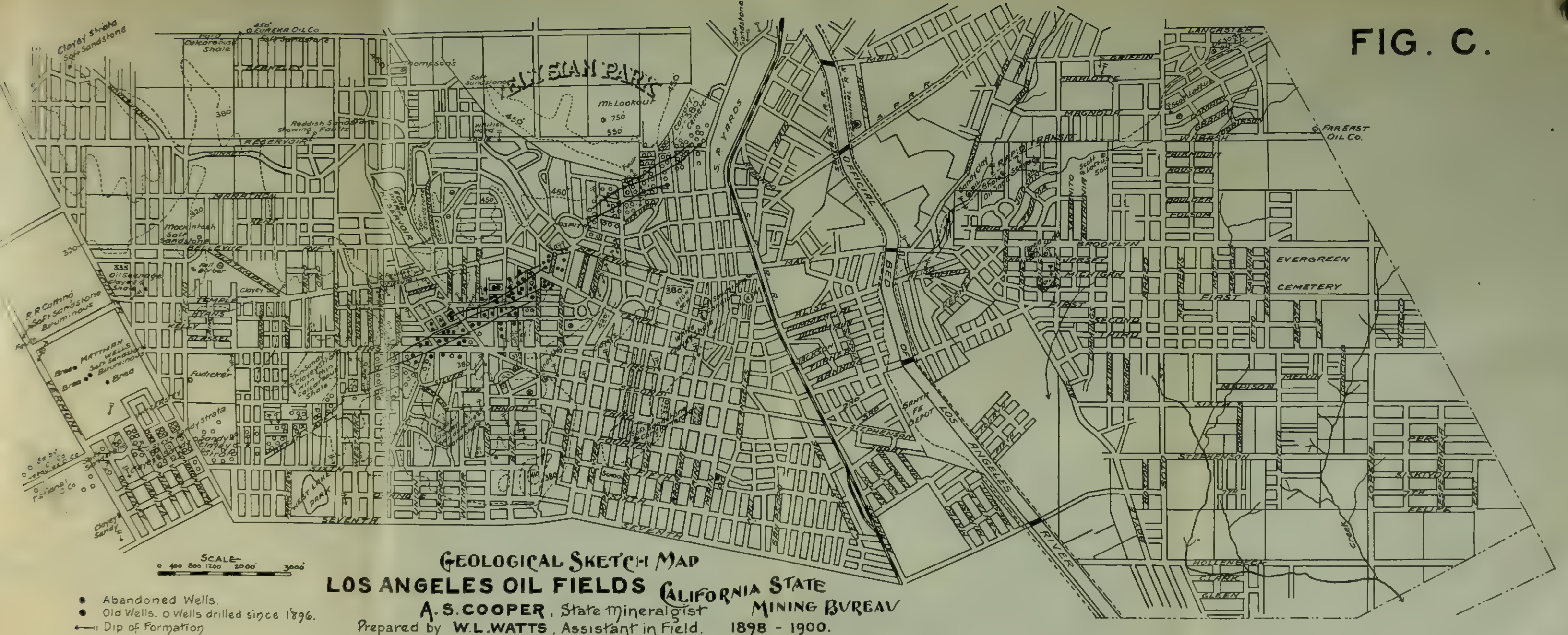


FIG. B.
GEOLOGICAL SKETCH MAP
OF
A PORTION OF FOOTHILLS OF
SANTA ANA MOUNTAINS
CALIFORNIA STATE MINING BUREAU
A.S. COOPER, State Mineralogist.
Prepared by W. L. WATTS.
Assistant in field.
SCALE:
0 ½ 1 1½ 2 Miles.
UNDER THE DIRECTION OF
HENRY T. GAGE
GOVERNOR OF THE STATE OF CALIFORNIA.
LEGEND:
Roads.
Railroads.
Contour Lines
Station
Dip of Strata
Sandstone Formation
Shales - (Brown & White)
Conglomerate "
Santa Ana River
RICHFIELD
YORBA 263'
OLIVE 226'
Burruel Pt
SOUTHERN CALIFORNIA
S. P. R. R.
MARLBORO
WANDA 301'
VILLA PARK
ORANGE
EL MODENA
Mc PHERSON 250
Santiago Creek
(Tustin Branch)
T. 3 S.
T. 4 S.

FIG. C.



GEOLOGICAL SKETCH MAP
LOS ANGELES OIL FIELDS CALIFORNIA STATE MINING BUREAU
A. S. COOPER, State Mineralogist
Prepared by W. L. WATTS, Assistant in Field. 1898 - 1900.
Under the Direction of HENRY T. GAGE, Governor of the State of California.

SCALE.

0 100 200 600 800 1000 1200 FT

FIG. D.

Geological Sketch Map (No. 2.) LOS ANGELES OIL FIELD

California State Mining Bureau - A. S. Cooper, State Mineralogist.

Accompanying Report of W. L. Watts.

Under the direction of HENRY T. GAGE, Governor of the State of California.

o New Wells.
• Old - prior to 1896.
Dip of exposed Strata.
& Strike of Oil Sand.

FIG. E.

GEOLOGICAL SKETCH MAP OF THE PENINSULA OF SAN PEDRO,

CALIFORNIA STATE MINING BUREAU.

A. S. COOPER, State Mineralogist —

Prepared by W. L. WATTS, Assistant in Field.

Under the Direction of

HENRY T. GAGE

GOVERNOR OF THE STATE OF CALIFORNIA.

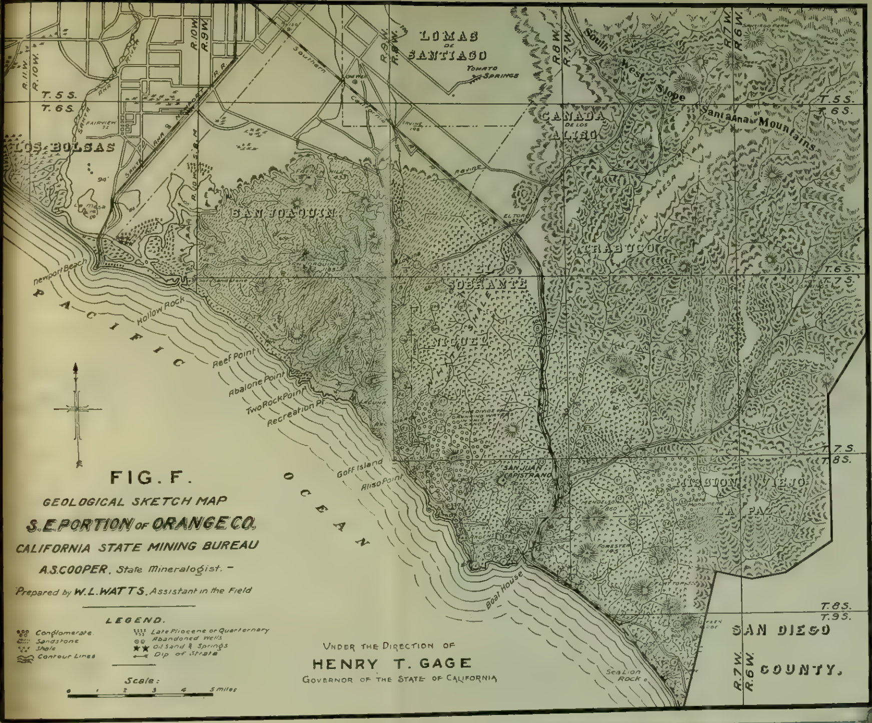


FIG. F.

GEOLOGICAL SKETCH MAP

S. E. PORTION OF ORANGE CO.

CALIFORNIA STATE MINING BUREAU

A. S. COOPER, State Mineralogist. –

Prepared by W. L. WATTS, Assistant in the Field

FIG. 6.
GEOLOGICAL SKETCH MAP
of TERRITORY BETWEEN
SESPE AND PIRU CREEKS
Ventura Co.
California State Mining Bureau
A. S. COOPER, State Mineralogist.
Prepared by W. L. WATTS, Assistant in the field. –
Under direction of
HENRY T. GAGE.
GOVERNOR of the STATE of CALIFORNIA.
1900.

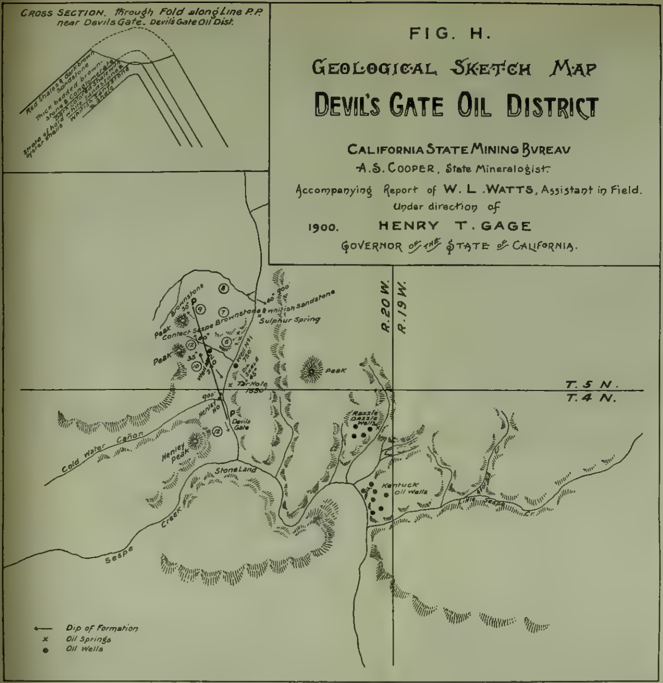


FIG. H.

GEOLOGICAL SKETCH MAP

DEVIL'S GATE OIL DISTRICT

CALIFORNIA STATE MINING BUREAU

A. S. COOPER, State Mineralogist.

Accompanying Report of W. L. WATTS, Assistant in Field.

Under direction of

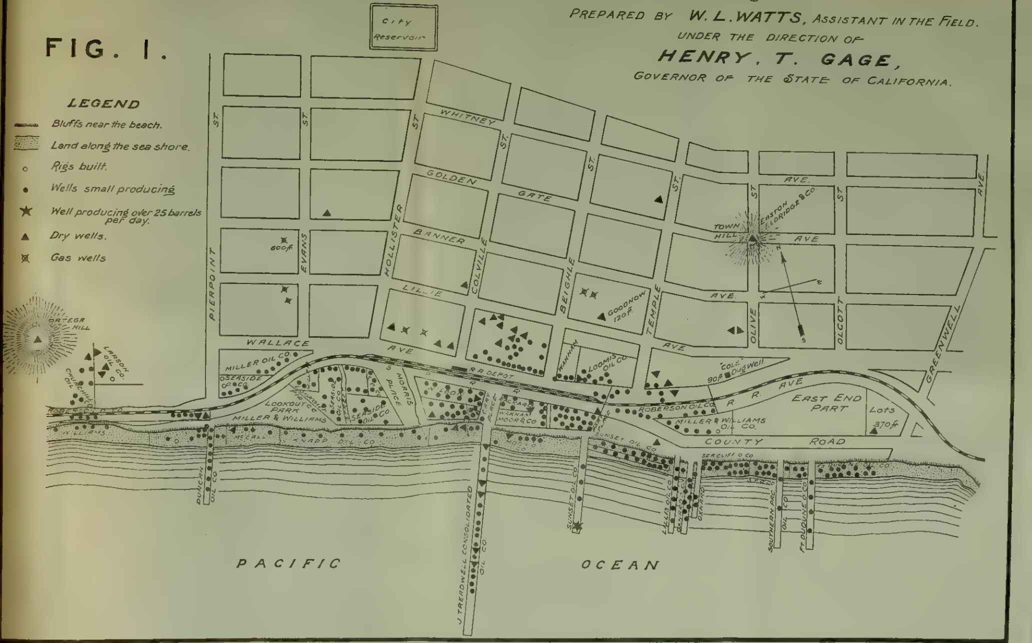
1900. HENRY T. GAGE

GOVERNOR of the STATE of CALIFORNIA.

SKETCH MAP OF SUMMERLAND SHOWING OIL WELLS AND WHARVES. ~

CALIFORNIA STATE MINING BUREAU, A.S.COOPER, State Mineralogist.

FIG. I.



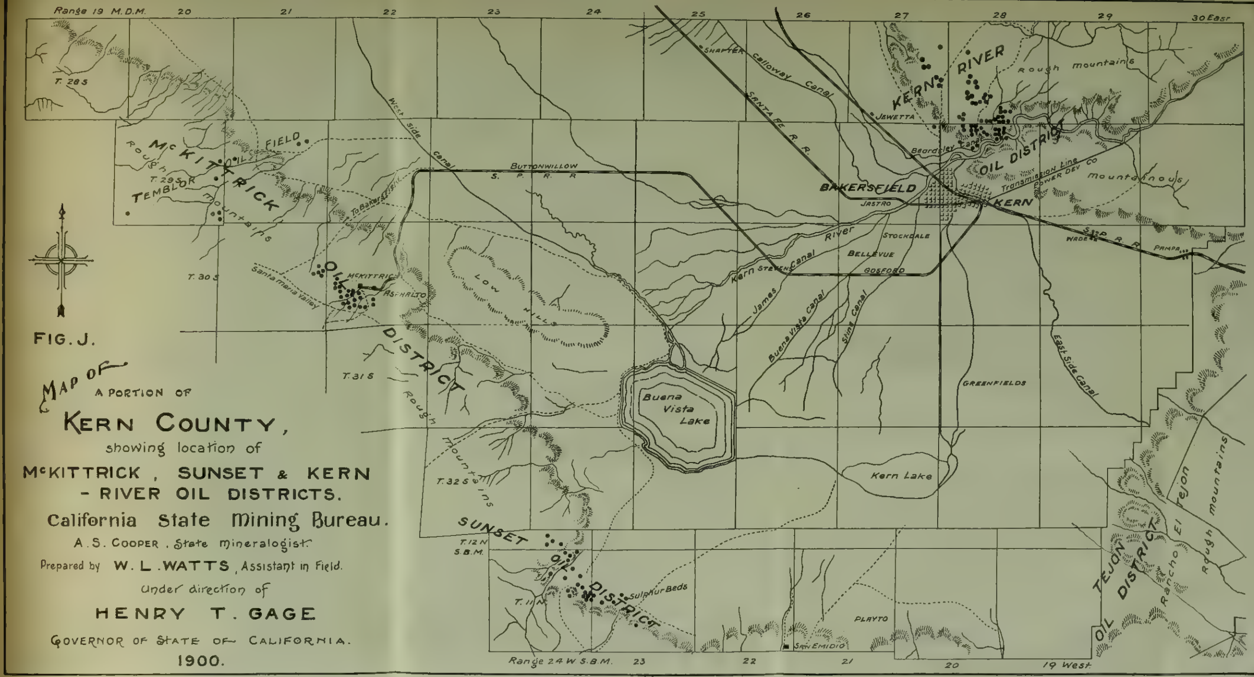


FIG. J.
MAP OF A PORTION OF
KERN COUNTY,
showing location of
McKITTRICK, SUNSET & KERN - RIVER OIL DISTRICTS.
California State Mining Bureau.
A. S. COOPER, State mineralogist.
Prepared by W. L. WATTS, Assistant in Field.
Under direction of
HENRY T. GAGE
GOVERNOR OF STATE OF CALIFORNIA.
1900.
Range 19 M.D.M.
20
21
22
23
24
25
26
27
28
29
30 East
Range 24 W. S.B.M.
23
22
21
20
19 West
T. 28 S
T. 29 S
T. 30 S
T. 31 S
T. 32 S
T. 12 N S.B.M.
T. 11 N
McKITTRICK OIL FIELD
TEMBLOR
Rough mountains
Santa Maria Valley
OIL DISTRICT
McKITTRICK
ASPHALTO
To Bakersfield
West side Canal
BUTTONWILLOW S. P. R. R.
Low Hills
Buena Vista Lake
Kern Lake
SUNSET OIL DISTRICT
Sulphur Beds
SAN EMIDIO
PLAYTO
KERN RIVER OIL DISTRICT
SHAFTER
Calloway Canal
SANTA FE R. R.
JEWETTA
Beardsley Canal
Rough mountains
BAKERSFIELD
JASTRO
KERN
Transmission Line Power Dev Co
mountainous
S. P. R. R.
WADE
PAMPA
Kern River
STOCKDALE
BELLEVUE
GOSFORD
Kern Stevens Canal
James
Buena Vista Canal
Stine Canal
GREENFIELDS
East Side Canal
TEJON OIL DISTRICT
Rancho El Tejon
Rough mountains

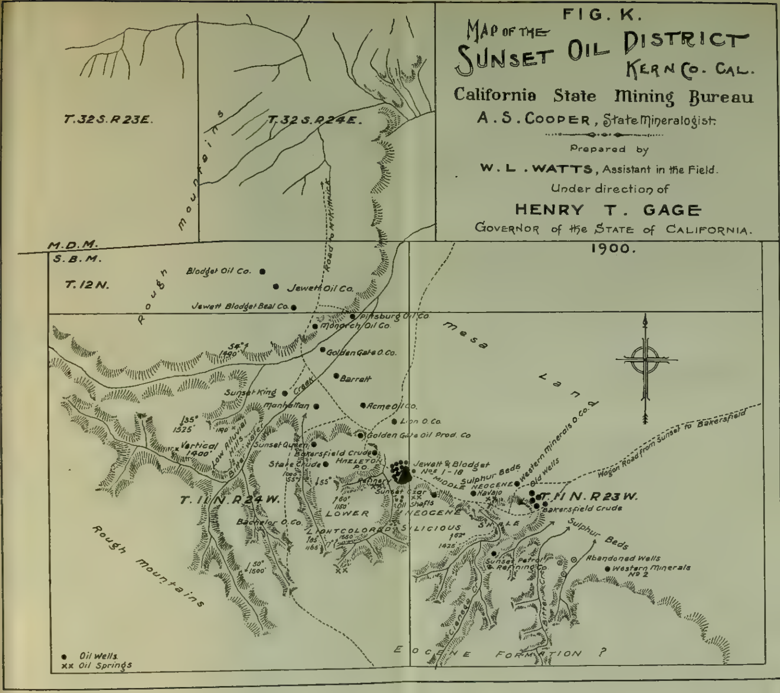


FIG. K.
MAP OF THE
SUNSET OIL DISTRICT
KERN CO. CAL.
California State Mining Bureau
A. S. COOPER, State Mineralogist.
Prepared by
W. L. WATTS, Assistant in the Field.
Under direction of
HENRY T. GAGE
GOVERNOR of the STATE of CALIFORNIA.
1900.
T. 32 S. R 23 E.
T. 32 S. R 24 E.
M. D. M.
S. B. M.
T. 12 N.
Rough Mountains
Road to McKittrick
Blodget Oil Co.
Jewett Oil Co.
Jewett Blodget Beal Co.
Pittsburg Oil Co.
Monarch Oil Co.
Golden Gate O. Co.
Barrett
Mesa Land
Sunset King
Creek
Manhattan
Acme Oil Co.
Lion O. Co.
Golden Gate Oil Prod. Co
Vertical 1400'
Low Hills
Alluvial
Bitter Water
Sunset Queen
Bakersfield Crude
State Crude
HAZLETON P.O.
Jewett & Blodget Nos 1-18
Refinery
Sunset Czar
Oil Shafts
Sulphur Beds
MIDDLE NEOCENE
Western Minerals O. Co.
Old Wells
Wagon Road from Sunset to Bakersfield
Navajo
T. 11 N. R 23 W.
Bakersfield Crude
T. 11 N. R 24 W.
LOWER NEOCENE
LIGHT COLORED SILICIOUS SHALE
Bachelor O. Co.
Sunset Petrol. & Refining Co.
Sulphur Beds
Abandoned Wells
Western Minerals No 2
Rough Mountains
EOCENE FORMATION ?
● Oil Wells.
XX Oil Springs

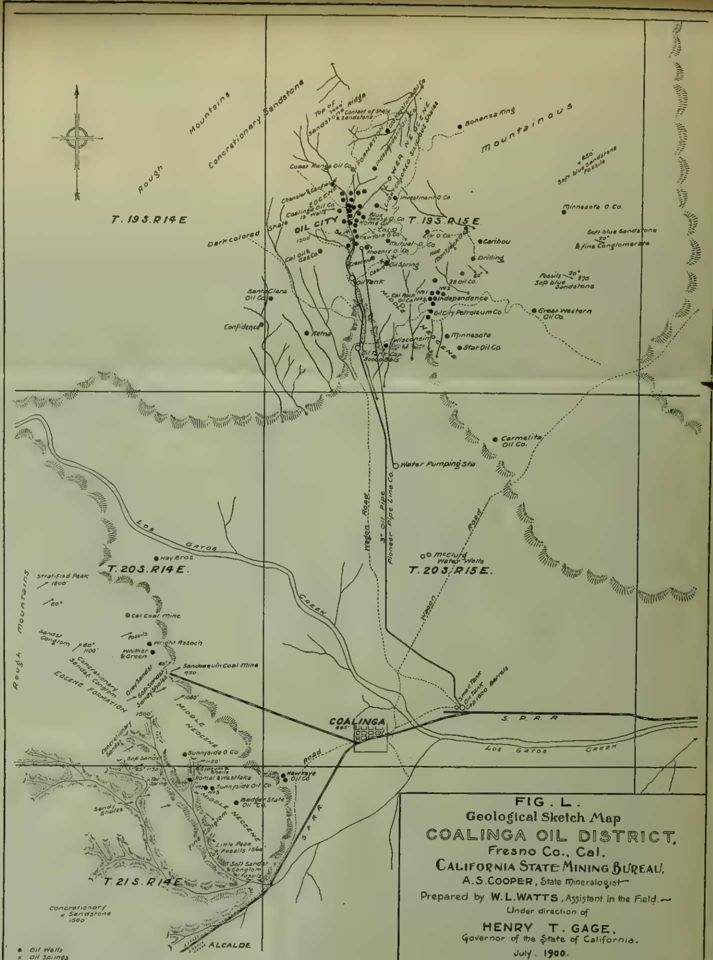


FIG. L.
Geological Sketch Map
COALINGA OIL DISTRICT,
Fresno Co., Cal.
CALIFORNIA STATE MINING BUREAU,
A.S.COOPER, State Mineralogist—
Prepared by W.L.WATTS, Assistant in the Field.—
Under direction of
HENRY T. GAGE,
Governor of the State of California.
July. 1900.
Rough Mountains
Concretionary Sandstone
Mountainous
T. 19 S. R14 E
T. 19 S. R15 E
T. 20 S. R14 E.
T. 20 S. R15 E.
T. 21 S. R14 E
OIL CITY
COALINGA
865'
Dark colored Shale
Coast Range Oil Co.
Coalinga Oil Co. 15 wells
Bonanza King
Minnesota O. Co.
Soft blue Sandstone 20° & fine Conglomerate
Caribou
Drilling
28 Oil Co.
Independence
Oil City Petroleum Co.
Great Western Oil Co.
Minnesota
Star Oil Co.
Santa Clara Oil Co.
Confidence
Retna
Oil Tank
Oil Spring
Carmelita Oil Co.
Water Pumping Sta.
3" Oil Pipe
Pioneer Pipe Line Co.
Wagon Road
McClure Water Wells
Los Gatos Creek
Hay Bros
Stratified Peak 1800'
Cal Coal Mine
Fossils
Wright Assoch
Whittier & Green
Sand & Conglom
Concretionary Sandst Conglom
EOCENE FORMATION
Sanjoaquin Coal Mine 950
Middle Neocene
Sunnyside O. Co
Romel & Westlake
Sunnyside Oil Co
Hawkeye Oil Co
Badger State Oil Co.
Sandy Shales
Fine Conglom
Little Peak Fossils 1860
Soft Sand & Conglom Fossils
Concretionary Sandstone 1500'
S. P. R. R
Road
Small Tank Oil Tank Cap 1600 Barrels
ALCALDE
Oil Wells
Oil Springs

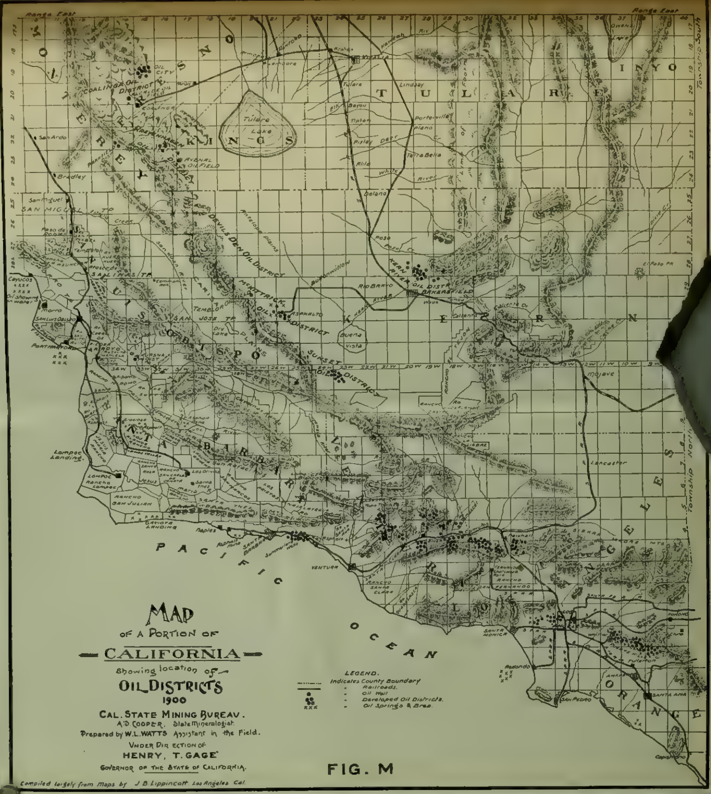

MAP
OF A PORTION OF
CALIFORNIA
Showing location of
OIL DISTRICTS
1900
CAL. STATE MINING BUREAU.
A. S. COOPER, State Mineralogist.
Prepared by W.L. WATTS Assistant in the Field.
UNDER DIRECTION OF
HENRY, T. GAGE
GOVERNOR OF THE STATE OF CALIFORNIA.
LEGEND.
Indicates County Boundary
Railroads.
Oil Well
Developed Oil Districts.
Oil Springs & Brea.
Compiled largely from Maps by J. B. Lippincott. Los Angeles Cal.
PACIFIC
OCEAN
MONTEREY
FRESNO
KINGS
TULARE
INYO
SAN LUIS OBISPO
KERN
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
COALINGA OIL DISTRICT
KERN RIVER OIL DISTRICT
DEVILS DEN OIL DISTRICT
MCKITTRICK OIL DISTRICT
SUNSET OIL DISTRICT
Tulare Lake
Visalia
Bakersfield
Mojave
Lancaster
Santa Barbara
Ventura
Santa Monica
Redondo
San Pedro
Santa Ana
Lompoc Landing
Range East
Township South
Township North

FIG. M

[illegible] [illegible]

[illegible]